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REPAIR CYCLE TIME REDUCTION AT NAVAL AVIATION DEPOTS VIA REDUCED LOGISTICS DELAY TIME

by

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This thesis is a study of an alternative acquisition program for piece parts that support readiness degrader aviation components. Components with outstanding piece parts with an acquisition lead times of greater than 45 days migrate to an awaiting parts status termed a supply condition code G. The U.S. Navy currently has more than 500 million dollars worth of components in G condition with more than 76 million dollars worth of piece parts outstanding. The current average time components at the Naval Aviation Depot North Island (NADEP-NI), California spends in G condition is 190 days. The major focus of the thesis is the development of an alternative acquisition system to investigate the effect of reduced acquisition lead times on repair cycle times and component inventory levels. The alternative acquisition system would reduce the acquisition lead time on all piece parts that are directly attributable to more than 20% of the applicable G condition components from an average of 199 days to only 60 days. This proposed change would reduce Logistics Delay Time (LDT) for the *steady state* components an average 32.4%, the average Repair Turnaround Time (RTAT) would be reduced an average 14.5% and the inventory levels would be reduced by 53 units or 4.42 million dollars. The comparison of the costs of the priority purchase system to the benefits indicates that for every one dollar invested in priority purchasing would result in 28 dollars in savings through reduced inventory levels.

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ABSTRACT

This thesis is a study of an alternative acquisition program for piece parts that support readiness degrader aviation components. Components with outstanding piece parts with an acquisition lead times of greater than 45 days migrate to an awaiting parts status termed a supply condition code G. The U.S. Navy currently has more than 500 million dollars worth of components in G condition with more than 76 million dollars worth of piece parts outstanding. The current average time components at the Naval Aviation Depot North Island (NADEP-NI), California spends in G condition is 190 days. The major focus of the thesis is the development of an alternative acquisition system to investigate the effect of reduced acquisition lead times on repair cycle times and component inventory levels. The alternative acquisition system would reduce the acquisition lead time on all piece parts that are directly attributable to more than 20% of the applicable G condition components from an average of 199 days to only 60 days. This proposed change would reduce Logistics Delay Time (LDT) for the *steady state* components an average 32.4%, the average Repair Turnaround Time (RTAT) would be reduced an average 14.5% and the inventory levels would be reduced by 53 units or 4.42 million dollars. The comparison of the costs of the priority purchase system to the benefits indicates that for every one dollar invested in priority purchasing would result in 28 dollars in savings through reduced inventory levels.

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LIST OF ACRONYMS

AIMD	Aviation Intermediate Maintenance Department
A_c	Component Availability
A_o	Operational Availability
ATAC	Advanced Traceability and Control
BCM	Beyond Capability of Maintenance
CRC	Component Repair Conference
D-LEVEL	Depot Level
DLR	Depot Level Repairable
DMISA	Depot Maintenance Interservice Support Agreement
DOP	Designated Overhaul Point
DSP	Designated Support Point
FIC	Family Identification Code
FISC	Fleet Industrial Supply Center
FLR	Field Level Repairable
G CONDITION	Awaiting Parts
I-LEVEL	Intermediate Level
IIC	Item Identification Code
LDT	Logistics Delay Time
M CONDITION	Undergoing Maintenance
MDT	Mean Down Time
MOV	Material Obligation Validation

MRIL	Master Repairable Item List
MRP	Material Requirements Planning
MTBM	Mean Time Between Maintenance
NADEP-NI	Naval Aviation Depot - North Island
NAVAIR	Naval Air Systems Command
NAVICP-P	Naval Inventory Control Point - Philadelphia
NIIN	National Item Identification Number
NMCS	Not Mission Capable Supply
NRFI	Not Ready For Issue
O-LEVEL	Organizational Level
PMCS	Partially Mission Capable Supply
RFI	Ready For Issue
RTAT	Repair Turnaround Time
TAT	Turnaround Time
TIR	Transaction Item Reports
WIP	Work In Process

I. INTRODUCTION

A. BACKGROUND

The Navy's repair process is a relatively simple system that is complicated by the complexity of the equipment, the cutting edge technology and the large range and depth of items it repairs. The Navy's inventory of aircraft and aviation related equipment is a complex array of components and systems. This complex equipment generally has numerous equally complex sub-components and piece parts.

The Navy is continuously attempting to stay abreast of improving technology and to maintain its aircraft and equipment as technologically superior. This dynamic environment greatly complicates the tasks of both the repair personnel and the logisticians who support it. Providing logistics support for new systems, systems that are on the cutting edge of technology and systems that are constantly being updated is a constant dilemma of what support equipment and spare parts to purchase and stock and in what quantities. These purchasing decisions naturally determine the inventory levels of components and piece parts. These inventory levels affect the ability of the navy aviation community to continually repair and fly aircraft to fleet readiness standards.

When navy aircraft components fail and are unable to be repaired by the organizational or intermediate level maintenance facilities they are transferred to the highest level maintenance facilities, the depots. Once items are at the depots they are scheduled, inducted, repaired and returned to the supply system as fully functioning components. During the repair process needs arise for piece parts to support the repair of components. Shortages of required

piece parts increases the time components spend in the repair process, this longer time spent in the repair process means that more components are required in inventory to meet readiness standards.

During the repair process if the need arises for a piece part in support of repair of a component, the piece part is either acquired from a local stock source or ordered. If the piece part that is ordered will not be delivered for more than 45 days the component it is ordered for will be transferred into an awaiting part status named G condition. [Ref. 1] Currently the navy has a large problem with G condition components. These components are not available to the fleet during this time so they are providing no positive purpose. The are currently over 500 million dollars worth of components in G condition with over 76 million dollars worth of piece parts outstanding. [Ref. 2] With the G condition problem being so massive any form of improvement should be assessed for the future benefit. This thesis will develop an alternative acquisition program and analyze the anticipated results.

B. THESIS OBJECTIVE

This thesis will analyze the repair process at the Naval Aviation Depot - North Island (NADEP-NI), specifically assessing the ramifications on the repair process of components in G condition. The thesis will attempt to develop a system to reduce the quantity of components in G condition and improve the performance measurements associated with it. The performance measures will include component availability, repair cycle time and the inventory quantity of the subject components.

C. ORGANIZATION OF THESIS

Chapter II will provide background information on the aviation component repair system and the supply system that supports it. Chapter III will provide background information on the practices at NADEP-NI. Chapter IV will provide an analysis of readiness degrader components. Chapter V will provide an analysis of an alternative acquisition program. Chapter VI will provide a summary, conclusions and recommendation.

II. BACKGROUND

A. ORGANIZATIONS INVOLVED IN REPAIR PROCESS

There are numerous organizations involved in the complex process of component repair. They range from the end-user or fleet unit to the shipping organization, the depot level repair organization, designated support organizations and the inventory management organizations. Each organization performs vital and unique tasks in the process of turning unserviceable repairable components into fully serviceable components ready to be issued when needed.

1. End-Users

The end-users are the front line personnel who are performing the maintenance on the aircraft. They can be a mechanic at sea on an aircraft carrier or at an ashore aviation squadron or an Aviation Intermediate Maintenance Department (AIMD). Regardless of who they are, to perform their mission they need the proper material support. They are not concerned with the price or the current level of material in various supply conditions, they simply want the material that will repair the job at hand.

The supply personnel who provide the local support to these mechanics are also considered end-users. Their main responsibility is to issue serviceable, "A" condition, components to the mechanics to affect repair. They are also responsible for obtaining the unserviceable, "F" condition component or carcass. Once they have the unserviceable carcass they must package and transfer it to a Designated Overhaul Point (DOP) as indicated by the Master Repairable Item List (MRIL). This transfer is accomplished via the Advance

Traceability And Control (ATAC) system by turning the carcass into the nearest ATAC NODE.

2. Advanced Traceability and Control Program

The Advance Traceability And Control (ATAC) Retrograde Depot Level Repairable (DLR) Program was developed to provide traceability, accountability, to establish centralized retrograde processing HUBs, to ensure Transaction Item Report (TIR) reporting to Inventory Control Points (ICPs) for all retrograde material, to reduce carcass tracking follow-ups and to reduce delays in movement and processing of retrograde components. [Ref. 3:p. 5090.3] There are currently two HUBs, one in Norfolk, VA and one in San Diego, CA. [Ref. 4] These HUBs make MRIL inquiries to determine the correct DOP and repack material for shipment. The NODEs are DLR collection, consolidation and transshipment points. There are currently 10 NODEs in operation.

3. Designated Overhaul Points

Every repairable component or Depot Level Repairable (DLR) has a Designated Overhaul Point (DOP) that performs the function of returning an unserviceable component, "F" condition, to a fully serviceable condition, "A" condition. If the component is beyond repair, the DOP has the authority to condemn the component. There are three types of DOPs, Organic or Naval facilities, commercial activities or other military service facilities via the Depot Maintenance Interservice Support Agreement (DMISA).

The naval facilities are Naval Aviation Depots (NADEPs) which are aviation industrial repair facilities that perform many aviation related functions of which one is the repair DLRs. The navy currently has three NADEPs located at Naval Air Station North Island, CA, Naval

Air Station Jacksonville, FL and at the Marine Corps Air Station, Cherry Point, N.C. The research for this thesis was conducted at the Naval Aviation Depot - North Island (NADEP-NI).

The determination of which DOP to use is made by referencing the Master Repairable Item List (MRIL). Once the DOP has been determined the component is transferred to the DOP via the ATAC program. The breakdown of the current DOPs being utilized to repair DLRs and the portion of repair funding they receive are listed in Table 2.1.

Table 2.1 Breakdown of Designated Overhaul Points and Repair Funding

Total Number of Repairable Components Managed			
69,000			
Designated Overhaul Points (DOPs)		Repair Dollars	
Organic (NADEPs)	3	Organic (NADEPs)	$486M
Commercial	274	Commercial	$295M
DMISA	11	DMISA	$90M
		Total	$871M

4. Designated Support Points

The Designated Support Points (DSPs) refer to the Fleet Industrial Supply Centers (FISCs) and supply departments which provide support to the NADEPs. Major DSP responsibilities include requisition monitoring, expediting, condition code transfers and custody exchange. [Ref. 1:p. 7q]

5. Naval Inventory Control Point - Philadelphia

The Naval Inventory Control Point - Philadelphia (NAVICP-P) is the item manager and has the responsibility for the overall management of its cognizant material. NAVICP-P provides integrated logistics support for naval aviation.

B. NAVY AVIATION MAINTENANCE LEVELS

The navy aviation maintenance system currently works under a three tiered system. Various forms of maintenance are performed at different levels based on the skill level of the personnel at each level and the capability of the facilities. The three levels of maintenance are Organizational (O-Level), Intermediate (I-Level) and Depot (D-Level).

1. Organizational Level Maintenance

Organizational level maintenance is performed by operational personnel at the operational site, the aircraft squadrons. The O-Level is generally more involved with the day to day operation of their respective aircraft than in-depth maintenance. The maintenance performed at this level is preventive maintenance basic general level maintenance such as visual inspections, periodic performance evaluations, cleaning, adjusting and the removal and replacement of some components. Generally these removed components are not repaired at the O-Level but forwarded to either the I-Level of D-Level for repair.

2. Intermediate Level Maintenance

Intermediate Level maintenance for aviation components is performed by Aviation Intermediate Maintenance Departments (AIMDs) which normally specialize in one or two types, models or series of airplanes. AIMDs are located both at sea on aircraft carriers and

large amphibious ships and ashore at naval air stations. Components are repaired at this level by the removal and replacement of unserviceable piece parts then returned to the local supply department as a Ready For Issue (RFI) component. These organizations have better equipped facilities and higher skilled maintenance personnel to affect repairs than O-Level organizations. The mission of these I-Level organizations is to provide on-site expeditious repair of components to facilitate operational readiness and maximize sortie generation and sustainability for deployed units. [Ref. 5:p. 115]

3. Depot Level Maintenance

Depot maintenance is performed at Designated Overhaul Points (DOPs) and is the most advance maintenance organization available to affect component repairs. It is designed to repair components that are beyond the capability of the I-Level organization. DOPs have better equipped facilities and higher skilled maintenance personnel to affect repairs than I-Level organizations. The DOP has the capability to completely rebuild, overhaul and calibrate complex equipment. [Ref. 5:p. 116]

4. Maintenance Codes

Maintenance codes are used to determine which maintenance level is deemed to be qualified to remove and replace an unserviceable component. This maintenance level determination is not an arbitrary decision but one that is made based on engineering assessments during the design phase of the equipment and an ongoing evaluation of the maintenance skills and capabilities at the three levels of maintenance.

The maintenance code is a two-position code that appears on the Allowance Parts List (APL) which is available to both the supply and maintenance personnel. The first position of

the code identifies the lowest maintenance level authorized to remove and replace the component. The second position of the code identifies the activity authorized to perform the maintenance on the removed component. [Ref. 6:p. VID-3-80]

C. COMPONENT CLASSIFICATION

There are basically three categories of parts in the navy. There are equipage items, repairable items and consumable items. Equipage items are generally non-installed durable items which are located in operating spaces or designated locations. Repairable items are components or parts designated by the cognizant inventory manager as items which can be economically repaired when they become unserviceable. Consumable items are simply all items that are not considered equipage or repairables. For this thesis repairable components are the main body of research with consumable items analyzed for their effect on Depot Level Repairable component repair.

Once a component is classified a repairable a determination must be made as to whether it is a Field Level Repairable (FLR) or a Depot Level Repairable (DLR). This determination will determine which maintenance level will perform the maintenance and possible condemnation. This determination is made utilizing the Material Control Code (MCC) for each component which is available on the Federal Logistics Catalog (FEDLOG). A Material Control Code of D identifies a component as a Field Level Repairable. A Material Control Code of E, G, H, Q or X identifies a component a Depot Level Repairable.

A component identified as an FLR is repaired or condemned at either the Organizational level or the Intermediate maintenance level in accordance with the Master

Repairable Item List (MRIL) and the applicable maintenance code. Very few of the navy's inventory of repairable components are field level repairables so they will not be considered further in this thesis.

A component identified as a DLR component must be submitted to the appropriate Intermediate or Depot Level Maintenance Facility via the ATAC program.

D. SUPPLY CONDITION CODES

The supply condition codes are used to determine readiness for issue and use. There are currently 17 condition codes the navy supply system uses ranging from issuable to scrap. For this thesis only four condition codes will be considered. These are the codes that are most applicable to this research and garner the most attention by the individuals involved in this process. The condition codes that will be considered are:

1. "A" Condition: New, used, or reconditioned material which is serviceable and issueable to all customers without limitation or restriction. Includes material with more than six months of shelf-life remaining.

2. "F" Condition: Economically repairable material which requires repair, overhaul, or reconditioning.

3. "G" Condition: Material requiring additional parts or components to complete the end item prior to issue, generally while in D-Level maintenance.

4. "M" Condition: Material identified on an inventory control record but which has been turned over to a maintenance facility or contractor for processing.

These codes are used and understood by all parties involved in the repair, management and induction process. Each condition code influences the actions of the organizations involved

in the repair process in a unique way. The organizations are affected differently by condition codes and the various condition codes affect the organizations differently.

Components in “A” condition influence the behavior of fleet organizations by determining which equipment can be repaired. If DLRs are stocked and the maintenance code specifies O-Level the equipment can be repaired. The main influence is then the stocking levels and the maintenance codes. The actions of the ATAC program, the Designated Overhaul Point (DOP) and the Designated Support Point (DSP) are not influenced by the quantity of components in “A” condition. The NAVICP-P, as the item manager has the responsibility for the overall management of material under its cognizance. It is therefore greatly influenced by the quantity of components in “A” condition. These quantities determine repair induction scheduling, component acquisition scheduling and geographical stocking location.

The quantity of “F” condition components has a tremendous influence on the scheduling and induction processes. Components in “F” condition affect the fleet unit’s material management techniques. They drive the end users to more closely monitor their serviceable as well as unserviceable components and force them to dutifully transfer their retrograde carcasses to the applicable DOP. These components are the main purpose for the establishment of the ATAC program. The ATAC NODE’s responsibilities are to accept accountability for the components and successfully transfer them to an ATAC HUB and then to the applicable DOP. The DOPs workload is directly influenced by the available quantity of “F” condition components. The quantity of “F”components also is an indicator of the quantity of parts and material that must be available to affect their repairs. NAVICP-P’s

concern with "F" condition components is that they are the basis for the number of components available for induction into the depot repair process.

Components in "G" condition are a major inhibitor to the successful operation of the Depot Level Maintenance program for components. The "G" components cause scheduling, production and storage problems. Currently there are more than $500M worth of components in "G" condition. These are components, if in "A" condition could be utilized to increase readiness by improved repair part availability and save precious acquisition dollars by decreasing the need to acquire additional "A" condition components. "G" condition components are a major problem for everyone involved. The fleet has fewer available "A" condition components because units that should be in the repair process are stalled awaiting parts. The ICP must dedicate manpower and resources to manage "G" condition components that could be utilized elsewhere. The DOPs must work their capacity around "G" components. The NADEPs repair a large range of components and if some of these components are delayed awaiting parts they must be separated from current work. This is even before an item is transferred from "M" to "G" condition. Once 45 days have passed, they must be documented as transferred from "M" to "G"condition, they must be moved to a packing area, packed for shipment and storage, if any parts are already received they must be attached to the component and they must be shipped to the Designated Support Point's (DSP's) warehousing site. The DSPs must be able to accurately track all "G" condition components and their current applicable parts. They must track the status of outstanding parts and be prepared to match incoming parts with the proper component. Once the outstanding parts have been received they and the applicable components are readied for shipment back

to the DOP. The DSP must notify the DOP when all the parts are received for a component and prepare them for reinduction. The DOP must have the flexibility in their schedule to accept the reinducted parts within two weeks of notification if there is an induction requirement. This places tremendous pressure on the DOPs to maintain a flexible schedule. This can lead to less than optimal production runs and higher repair costs per component. This flexibility must be considered by the DOP during the induction negotiations with the ICP.

The DSPs, DOPs and the NAVICP-P have formally defined responsibilities in the management of "G" condition components. These responsibilities are delineated in NAVAIR Instruction 4440.6D, Management of Condition Code "G" Repairable Components. [Ref. 1] The responsibility for each organization is as follows:

DOPs will perform the following tasks in the management of "G" condition repairable components:

1. Identify all parts requirements for an inducted component, screen NIF stocks to satisfy those requirements and submit NADEP funded requisitions to the supply system for those parts not available from NADEP owned stocks.

2. Prior to the transfer of to "G" condition, reconfirm non availability within NIF stocks. DOP will provide DSP with updated status on all parts requirements prior to transfer of repairable component.

3. Coordinate with DSPs to expedite those requisitions which are driving components to "G" condition.

4. Review "M" condition components that are awaiting parts and transfer to "G" condition within the 45 day or applicable time frame.

5. When transferring a component from "M" condition to "G" condition prepare and submit to the DSP a list of all outstanding parts requirements for the component.

6. Transfer all parts already received for a component along with the component when affecting an "M" to "G" condition code transfer.

7. All outstanding material requisitions, i.e., standard stock, locally manufactured or locally procured parts, will be redirected to the DSP controlled “G” storeroom for subsequent reinduction. This will be accomplished following the policy guidelines and responsibilities published for perpetuation of DOP requisitions.

8. Assist the DSP in “G” condition part switching decisions. Decisions should be made on repair capability and requirement necessity.

9. Upon notification from the DSP of “G” condition components ready for induction, reinduct within two weeks if there is an induction requirement. Prepare documentation to induct “G” condition components. Induct “G” condition prior to inducting “D,” “E,” or “F” condition components.

10. Coordinate “G” condition part expediting requirements with the DSP.

11. Buy the “minimum buy quantity” of part numbered items procured by the DSP for component repair.

12. Perpetuate the original ICP repair directive document number on reinduction from “G” condition.

13. Review parts requisitions and consider for NIF inventory those parts with two or more demands during a quarter.

14. Notify the DSP when the NADEP no longer has capability as the DOP for a component.

15. Coordinate with the DSP when processing Material Obligation Validations (MOVs). Transfer the MOV to the DSP for validation.

DSPs will perform the following tasks in the management of “G” condition repairable components:

1. Effect stock record condition code transfers from “M” to “G,” “G” to “M” and “G” to “F.”

2. Preserve and package components prior to “G” condition storage.

3. Provide storage space, staging area and record keeping for “G” condition components and associated material.

4. Match parts received from NADEP requisitions to components in “G” condition.

5. Provide expedite and follow-up services for NADEP requisitions. Continue to review NIF asset availability to fill outstanding requisitions.

6. Provide a list to the ICP of top “G” condition asset part concerns for ICP expediting action.

7. Notify the NADEP when all parts have been received for a “G” condition component and provide a weekly listing of all components in “G” condition that are ready for reinduction.

8. Ensure that all “G” condition components parts identified by the NADEP have had requisitions submitted to the supply system. Further ensure that requisition status is acceptable.

9. Submit monthly “G” management reports by the 10^{th} of the following month.

10. Switch parts between “G” condition components when switching will result in the re induction of a unit into the NADEP.

11. Provide “G” condition management reports to the NADEP and NAVICP-P on a scheduled basis.

12. The DSP will follow policy guidelines and responsibilities issued for DOP perpetuation of NADEP requisitions.

13. Provide feedback to the NADEP when the decision is made to survey or reclaim “G” condition assets vice reinduct so that requisitions and material can be disposed of properly.

14. Coordinate with the DOP when reconciling requisitions records and processing MOV responses in a timely manner.

The ICP’s responsibility in the management of “G” condition repairable components is as follows:

1. Act as principal NAVSUP agent for monitoring compliance with “G” condition management policy.

2. Coordinate with DSPs in the development of standard procedures for the efficient management "G" condition repairables.

3. Expedite "G" condition parts requirements for NAVICP-P cognizant items as identified by the DSP and the "ZZ0" project code.

4. Depot support teams will provide dedicated AWP expediting efforts as well as investigation of underlying causes of material support deficiencies.

5. Based on the large dollar value associated with "G" condition components, manage the attendant requisitions identified by project code "ZZ0" as priority requirements. Review supply response statistics routinely to ensure these requirements are satisfied expeditiously.

6. Identify parts which have high frequency rate in "G" condition components and take positive action to ensure availability of these items.

7. NAVICP-P will be responsible for managing and tracking the Working Capital Fund budget additive provided to fund NADEP perpetuated documents.

8. Under the automated "G" Management System, NAVICP-P will collect system-wide depot material support deficiency data, expedite critical repair parts, identify and resolve systematic and individual problems, perform numerous management analysis which highlight "G" condition management issues, and provide reports to NAVSUP 432/421 and NAVAIR 43 as requested. The reports will contain the following information:

   (a) Number of items in "G" condition, by site.

   (b) Number of units transferred from "M" to "G."

   (c) Number of units transferred from "G" to "M."

   (d) Number of units canceled "G" to "F."

   (e) Number of units in "G" with all parts received and awaiting reinduction.

   (f) Average "G" time.

   (g) Oldest item in "G" condition, number of units and reason for age.

   (h) Brief narrative on local "G" management trend, problems, initiatives, etc.

Components in "M" condition have little influence on the behavior of fleet organizations or the ATAC program. These components have a tremendous influence on the actions of DOPs since this condition is the actual workload of the DOPs. The quantity of the components in "M" condition is an indication of the current effect the DOP is having on fleet readiness. The actions of the NAVICP-P are influenced by these components, as the NAVICP-P has the responsibility for the overall management of these components. These quantities determine repair induction scheduling and new component acquisition determination and scheduling.

E. COMPONENT REPAIR FLOW

The Depot Level Repair component repair process is a complex process that involves many organizations and many individuals. This is a time intensive process that includes the shipping time from the fleet unit to the ATAC NODE, from the NODE to the ATAC HUB, from the HUB to the applicable DOP, it also includes the maintenance turnaround time TAT at the DOP and any delay time involved during the process.

The process begins when the end-user, a fleet unit experiences a failed or unserviceable component. The determination must be made as to who can remove and replace the component and who can repair it. The first position of the maintenance code is referenced to determine which maintenance level activity can remove and replace the failed component. Once this is accomplished then the second position of the maintenance code is referenced to determine which maintenance repair level is capable of affecting repair to the component. The unserviceable component or carcass is then removed from its parent equipment and replaced

by a serviceable component. The serviceable component was acquired from the supporting supply activity in exchange for the unserviceable component. The component is verified to be a DLR by verifying that its Material Control Code (MCC) is either E, G, H, Q or X. At this point the unserviceable component has been replaced by a serviceable component, the parent equipment is operating and the unserviceable component is in the hands of the supply department. The supply department must now submit the component to the proper maintenance activity for repair. The first activity to attempt repair of the component is the I-Level activity. When the I-Level activity does not have the capability to repair the component, the component is considered Beyond the Capability of Maintenance (BCM). Components that are BCM are transferred to the appropriate D-Level repair activity. The determination of the correct D-Level activity is made by referencing the Master Repairable Item List (MRIL) for the proper packaging procedures and the ultimate DOP. Once the component is properly packaged, it is submitted to the nearest ATAC NODE. The component is now considered to be in "F" condition.

The ATAC NODE transfers the component to the ATAC HUB supporting the DOP that will affect repair. The ATAC HUB will transfer the component to the Designated Support Point (DSP) for the repairing DOP. The component is stored at the applicable Defense Distribution Depot(DDD). Once a component is inducted, it is transferred from the DDD to the DOP. At this time the condition code is updated to an "M" condition and TAT begins. The DOP performs the required repair unless the component is beyond repair and must be condemned or there are insufficient parts to perform the repair. In the case of a lack of repair parts, if certain parameters are met, the component is put in "G" condition and

transferred back to the DDD until receipt of required parts. During the period the component is in "G" condition the TAT computation is suspended. When the required repair parts are received, they are bundled with the component at the DDD and transferred back to the DOP. At this point the component is returned to "M" condition and the TAT is restarted. When the component is fully repaired, the condition is updated to "A" condition and transferred to the DDD. The final step is transferring the component to the correct stock point according to NAVICP-P. [Ref. 7]

F. INDUCTION PROCESS

The repairable components induction system is performed by two different techniques, the Component Repair Conference (CRC) scheduling and the B08 sweeper induction program.

1. Component Repair Conference Scheduling (CRC)

The CRC scheduling applies to DLR Aviation Material (7R) and Airborne Armament Equipment (4Z) cognizance (COG) items whose depot repair is accomplished by a Navy Aviation Depot (NADEP) and whose repair requirements are scheduled at the semiannual Component Repair Conference (CRC). These are items that account for a large expenditure of repair dollars and are fast-moving items critical to fleet readiness. These are items with a demand of more than ten components per quarter and have a total annual repair cost of greater than $100,000. They are also the components that compromise the top 80% of the NADEP's workload in terms of man-hours.

Component Repair Conference scheduling is a system that attempts to optimize the use of the DOPs resources by minimizing fluctuations in production by leveling the induction quantities. Pre-negotiated quarterly schedules provide the DOPs with more stabilized workloads to promote efficient utilization of manpower and facilities. [Ref. 8]

The repair quantities to be inducted for CRC scheduling are computed based on total requirements, total RFI assets, RFI deficit/surplus, availability of NRFI assets, rework requirements, RFI surplus to schedule, and NRFI shortage to schedule.

The computed requirements will then be negotiated by NAVICP-P, the Naval Aviation Depot Operations Center (NADOC) and the DOPs into a firm production commitment for two quarters. These negotiations will take place at two semiannual Component Repair Conferences (CRCs). [Ref 9]

2. B08 Scheduling

The B08 induction process is a Uniform Inventory Control Point (UICP) Repairable Management Program which performs five major functions, i.e., Repair Requirements Scheduling, NRFI Redistribution, Maintenance/Overhaul (MOD)/Movement Priority Designator (MPD) Determination, Designated Overhaul Point (DOP) Workload Forecasting, and Component Rework Forecasting.

The weekly repair requirement is computed and transmitted only for Navy DOPs for 7R and 6K cog items. These requirements are categorized into four urgency levels. These levels reflect Fleet requirements based on existing file data and are unconstrained by piece parts or carcass availability or DOP capability or capacity. [Ref. 10:p. 2]

The individual DOP Production Requirement is factored by the Survival Rate to offset units that will be surveyed, formally written off financially and properly disposed of, and the amount of components in "M" condition at the DOP is deducted to compute the unconstrained repair requirement. The repair requirement is then constrained to available NRFI assets and the DOP's schedule limiter. [Ref. 10:p. 3]

If an imbalance of NRFI assets or capacity exists between DOPs, the deficiency will be realigned to the DOP with excess or assets or capacity. This process is applicable to all four levels of urgency levels. This redistribution is computed weekly and serves to correct both short term and long problems. The short term answer is to fill current repair schedule deficiencies. The long term answer is to preclude future NRFI deficiencies. [Ref. 10:p. 4]

Once the computations have been made the program transmits the requirements to the DOPs. The DOPs have NAVICP-P permission to modify their weekly induction procedures. This modification was predicated on the assumption that the stock status, capability, and capacity data available at the DOP at the time of the B08 schedule was being processed was more current than the data used by NAVICP-P in computing the B08 induction requirement. The DOPs use the production requirements segment of B08 and apply local in-process assets ("M" condition) to develop their own Local Induction Requirement (LIR). [Ref. 10:p. 4]

III. CURRENT PRACTICES

A. READINESS DEGRADERS

This thesis will analyze the shortage of piece parts required to affect the repair of unserviceable aviation Depot Level Repairable (DLR) components. These are components repaired or overhauled at Depot Level Repairable sites or Designated Overhaul Points (DOPs). The Naval Aviation Depot North Island (NADEP-NI) is one of three navy organic DOPs and is the DOP utilized in this research. The 15 components analyzed in this research are all repaired at NADEP-NI.

1. Operational Readiness

One of the major grading criteria for a naval aircraft squadron commander is the availability or operational readiness of that commander's squadron. Operational readiness is the degree to which the aircraft in a squadron are operable and in a committable state at the start of a mission when the mission is called for at an unknown random point in time. Operational readiness is a function of operating time or reliability and downtime or maintainability. [Ref. 5:p. 22] Reliability is the probability that an aircraft will perform in a satisfactory manner for a given period of time when operated under specified operating conditions. [Ref. 5:p. 22] Reliability is affected by the squadron's actions on the time between maintenance and operation of the aircraft but is also largely determined the characteristics of the design of the aircraft. The focus of this research will be on the maintainability function of operational readiness.

Maintainability is the ability of an aircraft to be maintained. Maintainability is determined by numerous factors including:

1. Mean Time Between Failure (MTBF) - the mean or average time between aircraft or aircraft component failures.

2. Mean Time Between Maintenance (MTBM) - the mean or average time between all maintenance actions, both corrective and preventive.

3. The Maintenance Downtime (MDT) - the total elapsed time required, when an aircraft is not operational, to repair and restore an aircraft to full operating status and/or to retain an aircraft in that condition.

4. Logistics Delay Time (LDT) - the maintenance downtime that is expended as a result of waiting for a spare part to become available as well as other delay factors.

5. Turnaround Time (TAT) - the element of maintenance time needed to service, repair and/or check out an item for recommitment. [Ref. 5:p.18]

2. Operational Availability

Operational readiness is the degree to which the aircraft in a squadron are operable and is determined by the reliability and maintainability of the aircraft. Operational readiness is utilized to measure the performance of a squadron subsequent to action. To predict future performance Operational Availability (A_o) is utilized. Operational availability is the probability that an aircraft, when used under stated conditions in an actual operational environment, will operate satisfactorily when called upon. Mathematically (A_o) is expressed as:

$$Ao = \frac{MTBM}{MTBM + MDT}$$

Operational availability is used to assess aircraft or components in realistic operational environments. [Ref. 5:p.70] MTBM is the major parameter in determining aircraft availability and overall effectiveness. [Ref. 5:p. 50] Mean Downtime is also a major factor of A_o with the key element in MDT being LDT. This means the time spent waiting for needed spare parts to complete repairs to a downed aircraft lowers the squadron's A_o. The LDT not only lowers the fleet's ability to repair its aircraft and hence A_o but it also lowers the DOP's TAT by delaying component repairs. The degree to which A_o and TAT are affected is dependent upon the length of LDT, the longer the LDT the lower the A_o and the longer the TAT. These factors provide the fleet and the DOPs both with clear incentives for seeking a reduction in LDT for all forms of maintenance.

Inventory quantities of both DLR components and consumable piece parts are directly affected by A_o and TAT. The current levels of A_o and TAT are achieved based on the current inventory levels of components and piece parts and the current LDT for all maintenance actions. High LDT is caused by insufficient piece parts, which causes delayed maintenance, increased MDT and lowered A_o. To prevent delayed maintenance and lower A_o additional components are purchased as inventory to facilitate quicker maintenance and higher A_o. These components are far more expensive than the piece parts that apply to them. Greater levels of piece parts reduce LDT which reduces the requirement for more expensive components.

3. Readiness Degraders

The direct relationship of spare parts availability to A_o has caused squadron commanders to become acutely aware of the non-availability of spare parts. They regularly

voice their problems to maintenance and supply personnel through a listing of the most serious and reoccurring component problems. The components comprising this listing are called readiness degraders. The listing of readiness degraders is provided to supply personnel at NAVICP-P and to maintenance personnel at both NAVAIR and the appropriate NADEPs. The listing of readiness degraders is used to determine which DLR components should be given the highest priority.

The shortage of RFI components has two degrees of effect on the readiness of a squadron. One is the possible effect on readiness by having less stock than anticipated by having insufficient quantities of RFI components in stock for corrective maintenance actions that have yet to occur. This effect is the given the lesser attention of the two degrees because the failures and the shortfalls have yet to happen and generally do not garner much attention from personnel other than the supply department personnel. The events that do not get the most attention are the instances where the shortage of RFI components causes aircraft to become unflyable or flyable with a reduced capability. These categories are termed Not Mission Capable Supply (NMCS) or Partial Mission Capable Supply (PMCS). These are the instances that drive the awareness of readiness degraders. In November of 1996 an analysis was performed by NAVICP-P which determined that 14% of the components that were in an awaiting parts status at the DOPs caused aircraft to be in an NMCS/PMCS status. [Ref. 9]

B. NADEP-NI INDUCTION PRACTICES

When a pilot notices that his aircraft is not fully functioning he notifies the squadron mechanics of the apparent problem. The squadron mechanics who are the Organizational

Level (O-Level) maintenance personnel will analyze the aircraft to determine the cause of the malfunction. In the situations when the malfunction has been diagnosed to be a faulty or unserviceable component and it is a DLR component the squadron mechanics will remove the component and replace it with a fully functioning or serviceable component. The mechanics will draw the serviceable component from the local supply department as an RFI DLR. The mechanics will at the same time turn the unserviceable component into the supply department. The supply department will first submit the component to the I-Level repair activity. When the I-Level activity does not have the capability to repair the component, the component is BCM and transferred to the appropriate D-Level repair activity. The supply department will ship the unserviceable component or NRFI DLR to the applicable DOP via the ATAC system.

Inventory Managers at NAVICP-P who are responsible for DLR components monitor the quantity of components in RFI or A condition, those in NRFI or F condition and other factors such as production leadtime and demand rate. Inventory Managers then based on all available factors compute quarterly repair requirements. These are preliminary requirements that are transmitted to the NADEPs approximately five weeks prior to the semiannual Component Repair Conference (CRC). The NADEP Planners and Estimators (P&E) meet with their repair shop personnel to adjust the preliminary requirements to meet shop capacity. [Ref. 8] The NADEP and the NAVICP-P personnel then present their respective schedules at the CRC. These schedules are then negotiated to develop a final quarterly production schedule. The Planners and Estimators (P&E) at NADEP-NI use the quarterly production figures to determine the weekly production quantities. P&E's then load their weekly

production quantities for each shop into the Weekly Induction Schedule (WIS 26) to produce a five day production schedule.

Job Cards are documents that list each maintenance step to be performed in the repair of unserviceable components. The job cards for each component to be inducted are produced at the local Defense Automated Printing Service center. Once printed these cards are sent to Defense Distribution Depot California (DDDC) where they will be matched to the inducted component. The production requirement is also passed to DDDC where the NRFI components are stored. The NRFI components are then picked from the shelves and readied for issue at the NADEP Central Induction Area. Defense Logistics Agency (DLA) personnel who work in the DDDC warehouse and NADEP personnel exchange custody of the components utilizing a bar code scanner that is part of the Barcoded Repairables Electronic Exchange Signature (BREES) system. The component is at this point considered to be in the custody of the NADEP. This information is transmitted via Transaction Item Reporting (TIR) to NAVICP-P to record the beginning of the Repair Turn-Around Time (RTAT). The components are then physically transferred from the DDDC warehouse to the NADEP dispatch center for the applicable repair shop. The components are then unpacked and verified. The components are then staged for induction into the repair shop.

Once a component is readied for work it is loaded into the Work In Process Inventory Control System (WIPICS). An artisan evaluates the component for determination of the level of repair or the need to survey. The artisan also determines the needed repair parts. The artisan will proceed to the Focus Stores activity which services his shop. Focus Stores are activities that store various piece parts to facilitate a simple and quick method for artisans to

acquire needed material. If the piece parts needed are not available at the Focus Stores then the parts are ordered through an Equipment Specialist and the component is placed in a delay status and returned to Production Control.

The piece parts are ordered off of a Bill Of Materials (BOM) and loaded into the NAVAIR Industrial Material Management System (NIMMS). When the piece parts are received, they are matched to the applicable component by Production Control and the component is loaded back to the shop via WIPICS. If the piece parts have an estimated shipping date greater than 45 days the components are transferred from an “M” material condition code, being processed for repair, to a “G” condition code, awaiting parts. As with the normal delay status when the piece parts are received the component is reinducted for repair. When the repair of components are completed the components are transferred to the shop dispatch area, from here the components are transferred to the NADEP production control area. At the production control area, as with the induction process NADEP and FISC personnel exchange custody of the components, at this point the RTAT stops. The components at this point are in the custody of FISC personnel who properly preserve and package the components to prevent damage during shipment and storage. The components are finally transferred to DDDC for storage as an RFI component. Figure 3.1 demonstrates the flow of the workload induction process.

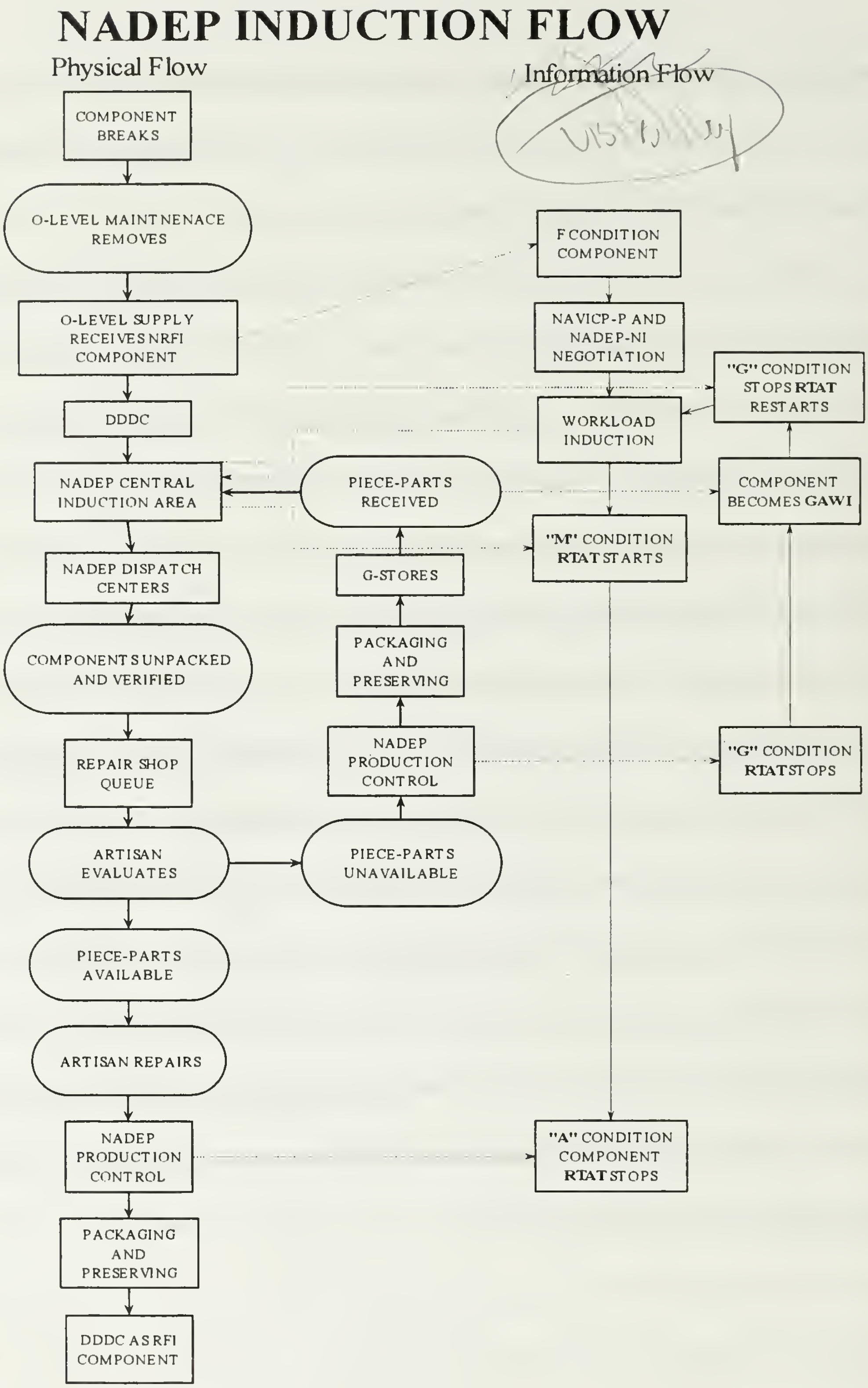

Figure 3.1 NADEP-NI Component Induction Flow

C. NADEP-NI G CONDITION MATERIAL FLOW

When piece parts that are ordered for the repair of a component have an estimated delivery date greater than 45 days the component is transferred from an "M" material condition code, being processed for repair, to a "G" condition code, awaiting parts. Due to the amount of time the component is delayed awaiting the piece parts to allow repair the RTAT is stopped during this time. The components are also moved out of the repair shops to prevent the repair shops from becoming inventory points. The requisition for the piece parts is transferred from the normal funding to G-Float funding. G-Float funding was established as a means to fund the induction of additional components to take the place of the components placed in G condition. These additional components are used to meet the original scheduled production goals. G-Float performed this by financing the outstanding requisitions for the G condition components. The original funding allocated for the repair of the components that were transferred to G condition was then de-obligated and used to finance the induction of the additional components.

The components, once they are determined to be destined for G condition, are transferred from the repair shop to the NADEP production control area. NADEP and FISC personnel exchange custody of the component and the RTAT stops while the component is in G condition. The components are properly preserved and packaged for storage while in G condition. The components are then transferred to the G-Stores warehouse. While components are in G condition they and the applicable outstanding piece-part requisitions are tracked by the G Management System (GMAN). This system utilizes a Component Migration Report to track the total number of items in G condition, the average time spent in G

condition, the parts that are required to return the components to the repair shops and other information. A sample GMAN Component Migration Report is demonstrated as Figure 3.2. The G-Stores personnel also use the Report of Possible Swaps from GMAN to swap piece parts to affect a complete component that can be reinducted for repair. [Ref. 12] When the outstanding piece parts have been received or swapped they are transferred from an awaiting parts (AWP) status to awaiting induction (AWI) status. When the repair shop has capacity to reinduct the components the components will be transferred from the FISC G-Stores personnel to the NADEP personnel, at this point the RTAT resumes. The components are then physically transferred back to the repair shop for repair and completion.

D. NADEP-NI G CONDITION CODE STATUS

According to the GMAN system the number of components at NADEP-NI in G condition and the average time these components spent in G condition have stayed relatively constant over the period July 1996 through September 1997. Figure 3.3 demonstrates the total number of units in G condition and Figure 3.4 demonstrates the average time components spent in G condition over the period July 1996 through September 1997.

G MANAGEMENT SYSTEM
COMPONENT MIGRATION REPORT
FOR DATES 06/24/97 - 07/01/97

A.	UNITS IN G CONDITION	-	4879	
	LEVEL SCHEDULE	-	4509	
	SPCC COMPONENTS	-	34	
	MISSILE COMPONENTS	-		
	OTHER	-	336	
B.	TRANSFERRED M TO G	-	186	
C.	TRANSFERRED G TO M	-	89	
D.	TRANSFERRED G TO F	-	0	
E.	WAITING FOR INDUCTION - 1010			
	0 - 14 DAYS	-	295	29 - PERCENT
	15 - 30 DAYS	-	252	25 - PERCENT
	31 - 90 DAYS	-	201	20 - PERCENT
	OVER 90 DAYS	-	262	26 - PERCENT

F. AVERAGE TIME IN G CONDITION

COMPONENTS IN G NOT AWC STATUS	-	4537
TOTAL DAYS OF ALL COMPONENTS	-	950798
AVERAGE TIME IN G CONDITION	-	210 DAYS

G. OLDEST ITEM IN G CONDITION -

QANA	FIC CODE
01-231-4819	NIIN
1992-055	AWP DATE
62	TOTAL COMPONENTS THIS NIIN

PARTS REQUIRED TO MAKE AWI

00-133-9282	PART NIIN	45 PARTS REQUIRED
00-780-4788	PART NIIN	18 PARTS REQUIRED
00-780-4797	PART NIIN	13 PARTS REQUIRED
LL-M30-4463	PART NIIN	1 PARTS REQUIRED
00-083-3516	PART NIIN	1 PARTS REQUIRED

Figure 3.2 GMAN Component Migration Report

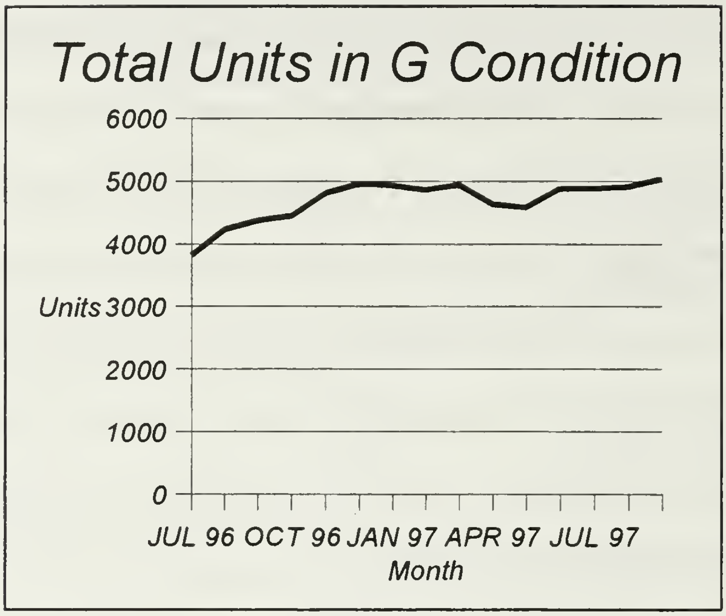

Figure 3.3 Total components in G condition at NADEP-NI

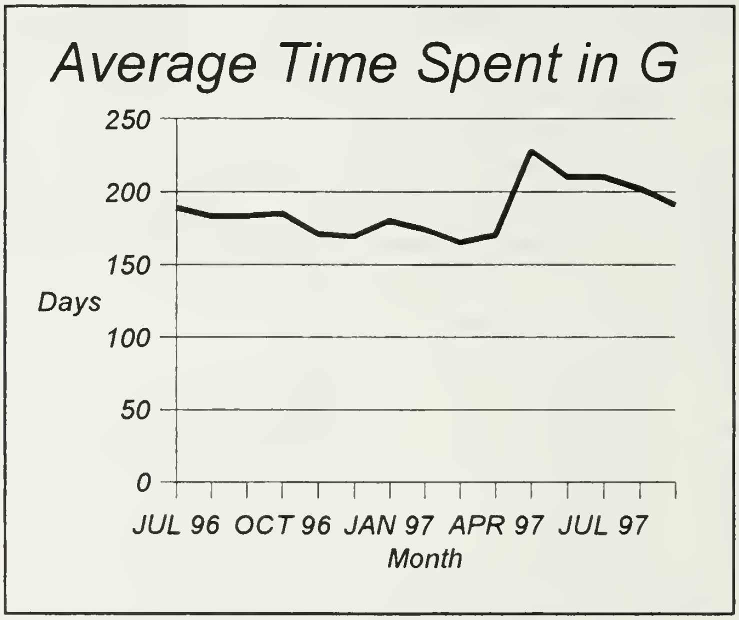

Figure 3.4 Average time G condition components spent in G condition at NADEP-NI

IV. ANALYSIS

A. ANALYSIS OF SAMPLE READINESS DEGRADERS

In this research five quarters of readiness degrader data was analyzed. This was readiness degrader data that was gathered from the Components Program Team at NADEP-NI. The quarters analyzed began with the fourth quarter of fiscal year 1996 and ended with the fourth quarter of fiscal year 1997. The readiness degraders where then divided into three patterns of occurrence, those occurring in all five quarters, those predominantly occurring in the latter quarters and those predominantly occurring in the beginning quarters. These three patterns are in this thesis termed *steady state degraders*, *evolved* Degraders and *reformed* Degraders respectively. An analysis was performed on six *steady state degraders*, five *evolved* degraders and four *reformed* degraders.

1. Steady State Degraders

The first category analyzed is termed *steady state degraders* because of their relative steady quantity of components in G condition during the five quarters analyzed. To be included in this category they first had to be considered a readiness degrader in all of the five quarters analyzed. From this point all possible candidates were analyzed to have at least ten components in G condition in three out of the five quarters. Once this was determined, a mean was taken of the quantities in G condition for the five quarters. For each candidate the quarterly quantities had to be within three standard deviations of the mean to preclude large variations. This would mean that not all of these candidates were actually *steady state* candidates. Six components met these requirements. The subject components, their

corresponding G condition quantities, the average quantity over the five quarters and the average quantity as a dollar value, based on the component standard price, [Ref. 13] are presented in Table 4.1. The supporting data is presented in Appendix A.

Table 4.1 Quantities of Steady State G Condition Components

STEADY STATE G CONDITION COMPONENTS							
Component Family ID Code	Quantity in G Condition Per Quarter					Average Values	
	4-96	1-97	2-97	3-97	4-97	Quantity	Total Extended $ Value
BS6A	13	13	13	13	17	13.8	$1,583,274.00
G5YA	17	23	21	23	31	23.0	$1,780,430.00
GQFA	25	32	43	37	32	33.8	$1,064,700.00
HCHA	173	204	181	91	130	155.8	$10,063,122.00
KNK1	8	10	12	6	12	9.6	$1,561,344.00
PK86	21	8	5	19	13	13.2	$169,884.00

2. Evolved Degraders

The second category of components are termed *evolved* degraders. These are components that had significant increases in the quantity of units in G condition over the five quarter period analyzed. The five components that fit this category are considered to have *evolved* as G condition readiness degraders during the five quarters. Some components evolved from as few as zero units in G condition in the first quarter. These components and their corresponding G condition quantities are presented in Table 4.2. The supporting data is presented in Appendix B.

Table 4.2 Quantities of Evolved G Condition Components

EVOLVED G CONDITION COMPONENTS							
Component Family ID Code	Quantity in G Condition Per Quarter					Increase Over Period	
	4-96	1-97	2-97	3-97	4-97	Quantity	Total Extended $ Value
6FNA	0	0	0	14	18	18	$318,420
C7WA	0	0	6	12	8	8	$707,680
FPUA	0	5	12	32	39	39	$1,600,170
FQAA	4	7	17	22	43	39	$2,193,750
HF2A	6	6	22	22	35	29	$3,010,780

3. Reformed Degraders

The third category of components are termed *reformed* degraders. These are components that had significant reductions in the quantity of units in G condition over the five quarter period analyzed. Although the G condition quantities were reduced considerably for the four components that fit this category, three out of the four components were still considered readiness degraders at the end of the fourth quarter of 1997. These components and their corresponding G condition quantities are presented in Table 4.3. The supporting data is presented in Appendix C.

Table 4.3 Quantities of Reformed G Condition Components

REFORMED G CONDITION COMPONENTS							
Component Family Item Code	Quantity in G Condition					Decrease Over Period	
	4-96	1-97	2-97	3-97	4-97	Quantity	Total Extended $ Value
G55A/B64A	15	9	0	0	0	15	$563,400
HHXA	24	30	15	8	7	17	$73,780
K1TA	34	35	24	22	13	21	$761,880
PE4A	5	6	4	3	2	3	$611,130

B. MATERIAL DEMAND

Each component becomes a G condition component because one or more of the piece parts required for repair of the component are not available at the time the repair is intended to be accomplished. To understand the cause of the G condition components an analysis of the demand for the individual piece parts is performed. The material demand analysis is performed for each component in each degrader category. Appendix D lists each component and the corresponding piece parts with the frequency of demand over the five quarter period.

For each component the individual piece parts were analyzed for their frequency of occurrence. Every component that was inducted was assigned a unique link number to facilitate tracking the component. When a component was transferred from M condition, being repaired at NADEP, to G condition, the link was maintained and identified on each requisition. A link may have had only one requisition when the component required only one piece-part to be repaired or it may have had numerous requisitions, one for each piece-part needed. The links therefore provided an indication whether components in G condition

regularly require single or multiple piece parts to be repaired. This information was valuable in determining the amount of effort and attention required to gain the needed piece parts and transfer components out of G condition back into M condition and eventually back to A condition. The quicker components can be transitioned through the maintenance process and back to A condition for the Fleet to utilize, the fewer quantity of components are required in inventory.

Appendix D identifies for each component the piece parts that were required and unavailable and therefore caused the components to migrate to G condition. The frequency of occurrence for each piece-part is also included to identify which piece parts are occurring most often and are the leading generators of G condition components. This was not enough information however, a determination had to be made as to whether the piece-part was causing components to migrate to G condition by itself or was one of a number of piece parts that caused the G migration. To determine this the links had to be analyzed.

A link with only one part outstanding required the acquisition of the single part to allow the component to migrate back to M condition. A link with numerous piece parts required the acquisition of all the piece parts before returning to M condition. All the links for each component were analyzed. Each link was analyzed each quarter for the quantity of piece parts outstanding. The links with only one or two parts outstanding were identified. It is hypothesized that the fewer the number of piece parts outstanding the more likely the chance that for quicker acquisition of these piece parts. The links with one or two piece parts outstanding were therefore analyzed to determine how much of a gain could be realized by putting priority on these piece parts and shortening the acquisition lead time for them.

1. Steady State Degraders

The six components in the *steady state* category were assessed for piece parts that could be prioritized to achieve noticeable improvements in TAT, number of components repaired, Operational Availability (A_o) or inventory levels. The first thing that had to be determined was the percentage of components that were in G condition due to each piece part. This was accomplished dividing the frequency of occurrence of each piece-part by the total number of components that were in G condition. This figure was used to focus attention on the most problematic piece parts. This information was not conclusive enough to identify the acquisition priority candidates. To better identify the proper candidates each link was assessed. The single and dual piece-part links that occurred most frequently and the percentage of the G condition components that were directly attributable to these piece parts are identified in Table 4.4. The percentages given indicate what percentage of the total G condition components could be returned to the Designated Overhaul Point (DOP) for repair with the acquisition of the piece-part or piece parts listed. This percentage, when considering all six components for all five periods is 35%. This means that with the acquisition of one or two piece parts more than one third of the components analyzed could have been transferred from G to M condition. This would result in a lower overall TAT and a higher A_o.

The component standard prices and the piece part prices are listed in Tables 4.5 through 4.9 to provide a comparison for each *steady state* component of the value of the components that are NRFI and the value of the piece parts required to make the components RFI. The cost of these outstanding piece parts can also be compared to the cost of having aircraft in a Not Mission Capable Status (NMCS) / Partially Mission Capable Status (PMCS).

Table 4.4 Steady State G Condition Components and Their Piece-Part Drivers

Component		Piece-Part		Quantity and Percentage of G Condition Components Attributable to NIIN				
FIC	Gross Price	NIIN	Net Price	4-96	1-97	2-97	3-97	4-97
BS6A	$114,730	01-135-8825	$6,910	8 .62	9 .70	10 .77	10 .77	7 .42
G5YA	$77,410	01-286-6703	$481	4 .24	4 .18	7 .34	3 .13	3 .10
GQFA	$31,500	01-161-4443	$3,280	5 .20	20 .63	22 .52	22 .60	12 .38
HCHA	$64,590	01-152-0644 01-134-1350	$1,293 $2,950	12 .07	12 .06	7 .04	15 .17	22 .17
KNK1	$162,640	No significant piece parts.						
PK86	$12,870	01-113-6161 01-113-6171	$1,833 $543	5 .24	1 .13	3 .60	6 .32	3 .23

Table 4.5 Piece-Part Cost and Component Value Analysis for Component BS6A

COMPARISON OF VALUE OF COMPONENTS TO BE REMOVED FROM G CONDITION AND THE COST OF Piece parts TO ACCOMPLISH THE REMOVAL			
QUARTER	QUANTITY	COMPONENT VALUE	PIECE-PART COST
4-96	8	$917,840	$55,280
1-97	9	$1,032,570	$62,190
2-97	10	$1,147,300	$69,100
3-97	10	$1,147,300	$69,100
4-97	7	$803,110	$48,370

Table 4.6 Piece-Part Cost and Component Value Analysis for Component G5YA

COMPARISON OF VALUE OF COMPONENTS TO BE REMOVED FROM G CONDITION AND THE COST OF Piece parts TO ACCOMPLISH THE REMOVAL			
QUARTER	QUANTITY	COMPONENT VALUE	PIECE-PART COST
4-96	4	$309,640	$1,924
1-97	4	$309,640	$1,924
2-97	7	$541,870	$3,367
3-97	3	$232,230	$1,443
4-97	3	$232,230	$1,443

Table 4.7 Piece-Part Cost and Component Value Analysis for Component GQFA

COMPARISON OF VALUE OF COMPONENTS TO BE REMOVED FROM G CONDITION AND THE COST OF Piece parts TO ACCOMPLISH THE REMOVAL			
QUARTER	QUANTITY	COMPONENT VALUE	PIECE-PART COST
4-96	5	$157,500	$16,400
1-97	20	$630,000	$65,600
2-97	22	$693,000	$72,160
3-97	22	$693,000	$72,160
4-97	12	$378,000	$39,360

Table 4.8 Piece-Part Cost and Component Value Analysis for Component HCHA

COMPARISON OF VALUE OF COMPONENTS TO BE REMOVED FROM G CONDITION AND THE COST OF Piece parts TO ACCOMPLISH THE REMOVAL			
QUARTER	QUANTITY	COMPONENT VALUE	PIECE-PART COST
4-96	12	$775,080	$27,113
1-97	12	$775,080	$28,769
2-97	7	$452,130	$15,678
3-97	15	$968,850	$39,841
4-97	22	$1,420,980	$68,611

Table 4.9 Piece-Part Cost and Component Value Analysis for Component PK86

COMPARISON OF VALUE OF COMPONENTS TO BE REMOVED FROM G CONDITION AND THE COST OF Piece parts TO ACCOMPLISH THE REMOVAL			
QUARTER	QUANTITY	COMPONENT VALUE	PIECE-PART COST
4-96	5	$64,350	$7,874
1-97	1	$12,870	$1,833
2-97	3	$38,610	$2,910
3-97	6	$77,220	$4,549
4-97	3	$38,610	$1,630

2. Evolved Degraders

The analysis of the *evolved* degraders determined that the methodology used to identify *steady state degraders* could also be utilized for *evolved* degraders. The piece-part drivers, their quantities and the percentage of the total G components they caused are listed in Table 4.10.

Table 4.10 Evolved G Condition Components and Their Piece-Part Drivers

Component		Piece-Part		Quantity and Percentage of G Condition Components Attributable to NIIN				
FIC	Gross Price	NIIN	Net Price	4-96	1-97	2-97	3-97	4-97
6FNA	$17,690	LL-L97-0113	$4	0	0	6 .43	7 .50	3 .17
C7WA	$88,460	01-328-2845	$11,250	0	0	2 .33	2 .17	2 .25
FPUA	$41,030	01-125-7671	$2,280	0	9 .75	9 .75	7 .22	4 .10
FQAA	$56,250	01-125-7672	$1,690	0	7 .50	6 .35	6 .27	3 .07
HF2A	$103,820	01-143-5351	$536	0	4 .67	5 .29	0	0

3. Reformed Degraders

The analysis of the *reformed* degraders determined that the methodology used to identify *evolved* and *steady state degraders* could also be utilized for *reformed* degraders. The piece-part drivers, their quantities and the percentage of the total G components they caused are listed in Table 4.11.

Table 4.11 Reformed G Condition Components and Their Piece-Part Drivers

Component		Piece-Part		Quantity and Percentage of G Condition Components Attributable to NIIN				
FIC	Gross Price	NIIN	Net Price	4-96	1-97	2-97	3-97	4-97
G55A	$37,560	No significant piece parts						
HHXA	$4,340	01-357-1227	$3,403	9 .38	3 .20	1 .07	0	1 .14
K1TA	$36,280	00-351-5371 LL-LP4-3988	$761 $362	9 .26	11 .31	6 .25	0	0
PE4A	$203,710	No significant piece parts						

C. IDENTIFIED READINESS DEGRADER COMPONENTS

The analysis of the three categories of readiness degrader components revealed that there was a strong correlation of single or dual piece-part drivers and the number of *steady state* components in G condition. The analysis revealed that for five out of the six *steady state* readiness degrader components a single piece-part or a combination of two piece parts were the cause for more than 35% of the subject components migrating to a G condition. The analysis also discovered that there was insufficient data to prove a relationship between piece-part drivers and the quantity of *evolved* or *reformed* components in G condition. The results of the analysis for the three readiness degrader categories demonstrate that only the five *steady state* components are sufficient to be utilized in assessing a new purchasing priority system and the resulting performance measures.

V. MODELING AN ALTERNATIVE SYSTEM

Chapter IV determined that for five out of the six *steady state* readiness degrader components a single piece-part or a combination of two piece parts were the cause for more than 35% of the subject components migrating to a G condition code status. These piece parts, termed drivers, had an average acquisition lead time of 199 days. This chapter will explore a system to improve the acquisition lead time of these driver piece parts and assess the resulting performance indicators. The performance indicators that will be assessed are the NADEP-NI repair cycle time or RTAT, aircraft operational availability (A_o) and component inventory levels in units and dollar value.

A. READINESS DEGRADER FORECASTING

Once the *steady state* readiness degraders were determined then a decision had to be made as to what was causing this condition. What was determined was that some piece parts were unavailable at the time they were needed. What was needed was a system to identify in a more in a timely fashion which parts were going to most effect readiness. What was to be avoided was buying too many piece parts and spending limited funding on material that had little demand and little probability of future demand. What needed to done was to purchase only what was needed. This would reduce the amount of capital tied up in material and reduce the amount of funding spent on holding costs. A method had to be developed to predict what piece parts had the highest probability of becoming problem items and purchase those parts.

To effectively do this a threshold of 20% will be established to trigger both the acquisition of material and the acquisition of the material in the correct quantities. This is a when the quantity of outstanding requisitions for any piece-part are causing more than 20% of the corresponding components to be in G condition. When piece parts reach this level, a priority requisition will be placed for these parts. This priority purchase will have a delivery date of no more than 60 days from the date of purchase. The quantity to be purchased will be only for the amount of piece parts outstanding. There will be no purchases for quantities greater than for what is currently needed. If priority purchases are placed for quantities greater than what is needed the possibility exists for the stockpiling of overpriced material. These components will cost more than conventional purchases because of their higher priority but they are justified because of the impact on the quantity of G components and the impact on the fleet's A_o. Any quantities above the priority quantity will be purchased under a normal contract.

The current average lead time for these piece parts are listed in Table 5.1. These are however not the only piece parts outstanding. To gain a complete understanding of the amount of time spent in G for these components, all of the piece parts outstanding must be analyzed for their lead time. The lead times for the remaining piece parts are also listed in Table 5.1. The lead times of these two categories of piece parts are then combined to give the total time the average component spent in G condition. This combined figure is the Total Average Logistics Delay Time (LDT) which is part of the figure Maintenance Down Time (MDT) that is used to derive the A_o for each component.

Table 5.1 Steady State Degraders' Piece-Part LDT in days

Component	Piece-Part Drivers LDT	%	Remaining Piece parts LDT	%	Total Average LDT
BS6A	378	.66	135	.34	295.4
G5YA	172	.20	133.6	.80	141.3
GQFA	200	.47	168	.53	183
HCHA	147	.10	298.8	.90	283.6
PK86	96	.30	160	.70	140.8

B. REPAIR CYCLE TIME

Repair Cycle Time is the amount of time required for the entire process of repairing a component. This includes the time required to transport an NRFI component from the end user to the Designated Overhaul Point (DOP), the actual repair time, any delay time during the entire process and the time required to return the component to an end user or supply point [Ref: 12]. Turnaround Time is one form of repair cycle time that is utilized by NADEPS to measure their performance. This is the time the NADEP works on a component or has the capability to work on a component. This time is computed from the time of induction until the component is returned to the supply system as an RFI component. It does not include the time components spend in G condition. The TAT measurement is important to the NADEPs for their self evaluations but does not provide an accurate measure of the repair cycle time. The TAT for each *steady state* component is listed in Table 5.2.

Table 5.2 NADEP TAT Repair Cycle Time

Component	TAT
BS6A	30
G5YA	26
GQFA	37
HCHA	42
PK86	39

This thesis has developed what is herein termed the NADEP repair cycle time or NADEP RTAT. The time RTAT, is computed from the time of induction for repair at the NADEP until the time the NADEP returns the component to the supply system as an RFI component. This time also includes any form of delay time termed LDT which is not included in TAT. For this thesis the time spent in G condition is the only delay time considered and is therefore considered LDT from this point on. The LDT that is added is the total average LDT that was computed in Table 5.1. This LDT does not however apply to all components that are repaired. The LDT only applies to the components that migrated to G condition. The LDT therefore can only be added for the G condition components. The amount of LDT to add is determined by multiplying the LDT by the percentage of components that migrate to G condition. This figure is a weighted average LDT that is then added to the TAT listed in Table 5.2 to determine RTAT. Table 5.3 lists the weighted average LDT and the RTAT for each *steady state* component.

Table 5.3 NADEP RTAT

Component	Total Average LDT	Percentage of Components that Migrate to G Condition	Weighted Average LDT	TAT	RTAT
BS6A	295.4	.16	47.3	30	77.3
G5YA	141.3	.17	24.0	26	50.0
GQFA	183.0	.18	32.9	37	69.9
HCHA	283.6	.07	19.9	42	61.9
PK86	140.8	.26	36.6	39	75.6

C. REDUCTION IN LOGISTICS DELAY TIME (LDT)

A factor in LDT that is a consistent dilemma or perceived dilemma is that there are too many piece parts that are causing components to migrate to G condition and these piece parts are different every quarter [Ref 10]. The findings from Chapter IV indicate that while there are numerous parts that cause the migration to G condition there are cases where one or two piece parts termed drivers cause a disproportionate number of G condition migrations. The degree to which these driver piece parts affect LDT and RTAT time can be reduced by utilizing the priority purchasing system described in section A of this chapter.

This thesis will model the effects of implementing a priority purchase system for driver piece parts. The priority purchase will achieve a lead time reduction from the current levels to one of only 60 days. The lead time reduction will be accomplished by providing financial incentives to the suppliers to provide the required piece parts within the a 60 day time frame. The incentive utilized by this thesis is premium pricing. The premium pricing cost will then be evaluated with the gain in component availability and with the possible inventory reductions to determine feasibility.

The priority purchases will be triggered when a piece part or a combination of two piece parts is the cause of more than 20% of the total units of a component in G condition. The new 60 day LDT for the piece part drivers is then added to the existing LDT for the remaining piece parts to produce the new total average LDT. Table 5.4 lists the new total average LDT utilizing the purchasing priority system.

Table 5.4 60 day LDT

Component	New Piece Part Drivers LDT	%	Remaining Piece Parts LDT	%	New Total Average LDT
BS6A	60	.66	135	.34	85.5
G5YA	60	.20	133.6	.80	118.9
GQFA	60	.47	168	.53	117.2
HCHA	60	.10	298.8	.90	274.9
PK86	60	.30	160	.70	130

The new total average LDT that is the result of the 60 day piece part LDT can be utilized to determine the new RTAT. The new total average LDT is multiplied by the percentage of components that migrate to G condition, similar to Table 5.3, to determine the weighted average LDT. This figure is then added to the TAT listed in Table 5.2 to determine the new RTAT. Table 5.5 illustrates the new RTAT as a result of the priority purchase system with the 60 day piece part LDT.

Table 5.5 NADEP RTAT Utilizing the Priority Purchase System

Component	New Total Average LDT	Percentage of Components that Migrate to G Condition	New Weighted Average LDT	TAT	RTAT
BS6A	85.5	.16	13.7	30	43.7
G5YA	118.9	.17	20.2	26	46.2
GQFA	117.2	.18	21.1	37	58.1
HCHA	274.9	.07	19.2	42	61.2
PK86	130	.26	33.8	39	72.8

D. IMPROVEMENT IN COMPONENT AVAILABILITY (A_o)

1. Operational Availability

Operational readiness is the degree to which the aircraft in a squadron are operable and is determined by the reliability and maintainability of the aircraft. Operational availability is the probability that an aircraft, when used under stated conditions in an actual operational environment, will operate satisfactorily when called upon. Mathematically (A_o) is expressed as:

$$Ao = \frac{MTBM}{MTBM + MDT}$$

Operational availability is used to assess aircraft in realistic operational environments [Ref 4:p.70]. This formula can be modified to measure forms of performance other than aircraft availability. This thesis will modify this formula to measure Component Availability (A_c) which is component availability to the fleet.

2. Component Availability

Component availability is developed by this thesis to determine the probability that a component, when repaired in an NADEP facility, will be available to the fleet as an RFI component. The availability is determined by utilizing the Mean Time Between BCM (MTBB) or the time between failures that the fleet cannot repair and the MDT. The component availability is mathematically expressed as:

$$Ac = \frac{MTBB}{MTBB + MDT}$$

Under the priority purchase system the NADEP RTAT is equivalent to MDT. Table 5.7 lists the current A_c for each *steady state* component utilizing the current MTBB and the MDT represented by the total LDT from Table 5.1. The A_c is the computed for each *steady state* component based on the priority purchase system utilizing the current MTBB and the MDT represented by the total LDT from Table 5.5. The two A_cs are then compared to determine the amount that component availability could be improved by the reduction in procurement lead time.

Table 5.6 Current and New Component Availabilities (A_c)

Component	MTBB	Current		New	
		MDT	A_c	MDT	A_c
BS6A	4703	76.3	.9841	43.7	.9908
G5YA	6524	50.0	.9924	46.2	.9930
GQFA	1649	69.9	.9593	58.1	.9661
HCHA	1649	61.9	.9638	61.2	.9644
PK86	3708	75.6	.9800	72.8	.9807

E. REDUCTION IN INVENTORY LEVELS

Little's Law is utilized to demonstrate the level of reduction in inventories that can be achieved with a reduction in cycle time. Little's Law is a demonstration of the relationship of flow time and the production rate and how they drive the inventory levels. Little's Law states that the in-process inventory for the factory as a whole equals the production rate times the average flowtime of jobs through the process [Ref. 13:p. 315]. Little's Law is expressed as formula illustrated below where L = In-Process Inventory, R= Production Rate and W = Average Flowtime of Jobs.

$$L = RW$$

The production rate is the arrival rate of components to the NADEP repair process. The production rate was derived from the average daily induction for each component over Fiscal Year 1997. The flow rate is the NADEP repair cycle time or MDT for each component. The product of these two factors produces the Work In Process (WIP) inventory. Table 5.7 demonstrates the inventory levels based on the current MDT and the inventory levels based on the MDT that can be derived from the priority purchase system.

Table 5.7 Current and New Inventory Levels

	Current			New		
Component	Induction Rate	MDT	Inventory	Induction Rate	MDT	Inventory
BS6A	.100	76.3	7.63	.100	43.7	4.37
G5YA	.272	50.0	13.60	.272	46.2	12.57
GQFA	.404	69.9	28.24	.404	58.1	23.47
HCHA	.292	61.9	18.07	.292	61.2	17.87
PK86	.296	75.6	22.38	.296	72.8	21.55

F. DOLLAR VALUE SAVINGS OF LOWER INVENTORY

The lowered inventory levels were then transformed into dollar value savings by lowered capital investment in inventories and lowered holding costs. The lower required inventory levels were the result of the lower WIP inventories due to faster throughput in the repair process. The quantity of the reductions were multiplied by the full price for each component to determine the total savings. Table 5.8 lists the quantity reductions and the value of the reductions.

Table 5.8 Value of Inventory Reduction

Component	Component Price	Quantity of Reduction	Value of Reduction
BS6A	$114,730	33	$3,786,090
G5YA	$37,560	4	$150,240
GQFA	$31,500	12	$378,000
HCHA	$64,590	1	$64,590
PK86	$12,870	3	$38,610
TOTAL			$4,417,530

G. PRIORITY PURCHASE ACQUISITION COSTS

The reduction of the acquisition lead time for the identified piece parts is not a cost free process. To achieve the reduction in the acquisition lead time from the current levels to one of 60 days will require providing financial incentives to the suppliers. The incentive utilized by this thesis is premium pricing. Premium pricing is the result of taking the current price and multiplying it by a premium rate, such as 200 percent of the current price. The

premium rate will vary with each situation because of the quantity demanded and the supplier's capacity. To allow for modeling and analysis, one overall premium rate will be utilized.

The premium rate utilized in this thesis will be a rate of 150 percent or a price of 150 percent of the normal price. This figure is based upon talking to several contracting officers. The premium rate is used to compute the priority purchase price for each piece part. This price is multiplied by the quantity of piece parts required to remove components from G condition over the five quarter period analyzed to produce the total cost of the priority purchase system. The total cost for the piece parts using the current prices are subtracted from the total cost of priority purchasing system to determine the total net increase in costs. The total net increase in costs represents the costs incurred to achieve the reduced lead time. The number of piece parts required for the five steady state components modeled, their current prices, priority purchase prices and the total increased cost are illustrated in Table 5.9.

Table 5.9 Total Priority Purchase Acquisition Costs

Piece Part	Quantity Required	Current Price	Total Current Cost	Priority Purchase Price	Total Priority Purchase Cost	Total Cost Increase
01-135-8825	9	$6,910	$62,190	$10,365	$93,285	$31,095
01-286-6703	11	$481	$5,291	$722	$7,937	$2,646
01-161-4443	38	$3,280	$124,640	$4,920	$186,960	$62,320
01-152-0644	13	$1,293	$16,809	$1,940	$25,214	$8,405
01-134-1350	27	$2,950	$79,650	$4,425	$119,475	$39,825
01-113-6161	7	$1,833	$12,831	$2,750	$19,247	$6,416
01-113-6171	11	$543	$5,973	$815	$8,960	$2,987
TOTAL						$153,692

H. COST OF PRIORITY PURCHASING VERSUS REDUCED INVENTORY

Section F determined that the inventory levels could be reduced, while keeping the A_c steady, by a total value of 4.4 million dollars. Section G determined that the cost of achieving the priority purchasing system to achieve the inventory reduction would cost 153 thousand dollars. The comparison of the costs to the benefits indicates that for every one dollar invested in priority purchasing would result in 28 dollars in savings through reduced inventory levels.

VI. CONCLUSIONS AND RECOMMENDATIONS

The focus of this thesis has been on the reduction of repair cycle time at NADEPs through reductions in the length of time components spent awaiting piece parts. The benefits of reductions in repair cycle times were measured by analyzing the effects on performance measurements such as Component Availability (A_c) and the amount of financial investment in inventory stock. The derived benefits were then compared to the costs of the priority purchase program.

The U.S. Navy has more than 500 million dollars worth of components in G condition with another 76 million dollars invested in outstanding piece part requisitions. The G condition code system has grown to a level that warrants tremendous attention. The Naval Inventory Control Point - Philadelphia, the Naval Air Systems Command and the NADEPs have invested tremendous amounts of personnel time and resources in an attempt to control the G condition situation and bring improvements to the program and the performance measures. With these large investments the program has still managed to continue to be a large detractor in the ability of the Navy to repair vital equipment in a timely and cost effective manner.

In this thesis fifteen readiness degrader components were analyzed for a determination of the piece parts that caused them to migrate to the G condition system. The fifteen readiness degrader components were separated into three different categories for comparative analysis. The components were placed in one of the three categories based on the quantity of units in G condition over the five quarter period from July 1997 to October

1997. The categories were *steady state, evolved* and *reformed.* An analysis was then performed on the components and piece parts in each of the three categories.

A. CONCLUSIONS

1. The major underlying cause of the G condition problem with component repair is the lack of adequate forecasting.

The priority purchase system developed in this thesis is a responsive system, responsive to the problem of the G condition components, it is a patch work system designed to correct a flawed forecast for piece parts. The true corrective action would be to develop a system that correctly forecasts piece parts prior to induction and hence would eliminate the need for the G system. The results of this priority purchase system indicate that there is a positive gain to be achieved by this system.

2. A common misconception of the G condition problem is that there is no pattern to the frequency of piece parts that are causing components to migrate to G condition.

Five components considered *steady state* readiness degraders were analyzed for reduced LDT by utilizing the priority purchase system. The thesis discovered that 35% of these *steady state* readiness degrader components were in G condition due to one or two piece parts.

3. Considerable improvements can be made to the G condition situation without investing considerable funding.

The piece parts identified were placed under a priority purchase system in which the piece parts would be acquired within 60 days vice the current average lead time of 199 days. The results indicated that the total average LDT for the *steady state* components could be

reduced an average 32.4% and the average RTAT could be reduced an average 14.5%. The results also indicated that the A_c could be increased by an average of .0168 % and the inventory levels could be reduced by 53 units or 4.42 million dollars. The comparison of the costs of the priority purchase system to the benefits indicated that for every one dollar invested in priority purchasing would result in 28 dollars in savings through reduced inventory levels.

B. RECOMMENDATIONS

1. All improvements in the component repair process should be pursued no matter how small they may appear.

All commands involved in any way with the G condition system or components in the system should continue to seek any improvements to the G condition problem no matter how small they may seem. The changes in the A_c achived in this thesis may seem small and the 4.4 million dollar reduction in inventory may only be a small fraction of the Navy's total inventory, but they do provide improved utilization of current resources. The cost and benefit analysis indicates that the program developed and analyzed in this thesis is a worthwhile investment.

2. MRP II should be utilized but utilized inteligently.

The G condition problem requires the seemingly simple concept of acquiring the required piece parts prior to the induction of components into the repair process. Material Requirements Planning (MRP) II is a possible solution to the problem and is currently being developed for use at the NADEPs. MRP II will identify the required piece parts prior to induction and will not allow induction until all the required parts are acquired. MRP II is

designed for a production process where the required parts are known before production. The lack of perfect forecasting makes the determination of the needed parts for repair more complicated. The MRP II solution to the problem of predicting how many seals to have available is by the use of replacement factors. Replacement factors are probability of need factors based on historical demand figures. Then based on these figures the proper number of piece parts will be acquired before induction into the repair process. For MRP II to function effectively the majority of effort must be placed on determining the most accurate replacement factors. If replacement factors are inaccurate, the MRP II system is not worth the effort expended to implement it. Replacement factors must also be continuously update to reflect the latest trends.

3. All NADEP personnel should be aware of the repair cycle times and how they affect them.

We recommend that all NADEP personnel should be knowledgeable of the RTAT and should be provided incentives to seek improvements in it. At this point the RTAT figure is of little concern to the majority of personnel at the NADEPs because they are not measured by it, they are measured by TAT.

4. Change the iduction scheduling system.

The current long term scheduling technique, Component Repair Conference (CRC) scheduling, does not incentivize NADEP repair shops to repair more components. When NAVICP-P requests larger than usual quantities of components repaired, due to demand, in the initial CRC request the repair shops routinely ask for the quantities to be spread evenly over two quarters [Ref 14]. This does not accomplish the need for more components. Shops

will also build up stock of RFI components in excess of the CRC schedule and hold the excess components until the next quarter for flexibility. These components should be returned to the supply system as RFI components as soon as possible. Incentives should be developed for the shops to have this system work in their favor.

APPENDIX A. STEADY STATE READINESS DEGRADERS

Table A.1 Steady State Readiness Degrader Data for Quarter 4 1996

QUARTER 4 1996

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
BS6A	1437	STRUT	29	115	212.52	6	13	3	V	18	18	3	3	3	3	15
G5YA	1474	D-DSPL-IND	22	22	25.71	243	17	10	V	28	28	10	10	10	10	18
GQFA	1429	DRIVE UNIT	29	11	17.25	10	25	12	V	27	27	17	17	17	17	10
HCHA	1416	AMAD	52	63	134 87	10	173	10	V	54	54	23	23	23	23	31
KNK1	3791	DOPPLER A	39	196	144.5	180	8	15	S	0	0	0	0	0	0	17
PK86	1639	DAMPER-CYL	30	73	6.15	17	21	0	V	17	17	2	2	2	2	15

Table A.2 Steady State Readiness Degrader Data for Quarter 1 1997

QUARTER 1 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
BS6A	1437	STRUT	29	52	161 1	2	13	29	V	28	28	15	4	15	4	18
G5YA	1474	D-DSPL-IND	22	15	27 1	260	23	35	V	20	20	10	0	10	0	11
GQFA	1429	DRIVE UNIT	30	24	21.7	4	32	35	V	43	43	20	1	20	1	20
HCHA	1416	AMAD	54	81	134 87	14	204	10	V	20	20	10	0	10	0	20
KNK1	3791	DOPPLER A	39	196	144 5	188	10	17	S	0	0	5	2	5	2	14
PK86	1639	DAMPER-CY	32	56	13.47	13	8	25	V	35	35	25	4	25	4	32

Table A.3 Steady State Readiness Degrader Data for Quarter 2 1997

QUARTER 2 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
BS6A	1437	STRUT	29	112	161 1	12	13	7	V	15	15	0	4	0	4	11
G5YA	1474	D-DSPL-IND	22	22	25.71	246	21	41	V	0	0	0	13	0	13	13
GQFA	1429	DRIVE UNIT	31	55	21.7	47	43	50	V	39	39	0	13	0	15	6
HCHA	1416	AMAD	56	39	134 9	59	181	135	V	30	30	0	6	0	6	23
KNK1	3791	DOPPLER A	39	196	144 5	6	12	37	S	5	5	0	1	0	1	5
PK86	1639	DAMPER-CY	34	88	13.1	34	7	16	V	51	51	0	5	0	5	27

Table A.4 Steady State Readiness Degrader Data for Quarter 3 1997

QUARTER 3 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
BS6A	1437	STRUT	29	126	161.1	9	13	32	V	11	11	4	2	4	2	14
G5YA	1474	D-DSPL-IND	22	22	25.71	216	23	41	V	0	0	29	19	29	19	28
GOFA	1429	DRIVE UNIT	31	23	21.7	28	37	59	V	56	56	31	12	31	12	30
HCHA	1416	AMAD	61	41	210.6	51	91	137	V	31	31	15	5	15	5	4
KNK1	3791	DOPPLER A	39	17	144.5	72	6	60	S	1	1	1	1	1	1	3
PK86	1639	DAMPER-CYL	30	73	6.15	12	19	24	V	0	0	25	0	25	0	32

Table A.5 Steady State Readiness Degraders Data for Quarter 4 1997

QUARTER 4 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
BS6A	1437	STRUT	29	104	161.1	9	17	25	V	10	10	5	3	5	3	9
G5YA	1474	D-DSPL-IND	22	22	25.71	111	31	29	V	0	0	7	3	7	3	16
GOFA	1429	DRIVE UNIT	31	46	21.7	7	32	48	V	56	56	37	26	37	26	25
HCHA	1416	AMAD	62	37	210.6	146	130	81	V	33	33	15	5	15	5	12
KNK1	3791	DOPPLER A	39	0	144.5	171	12	14	S	0	0	0	0	0	0	0
PK86	1639	DAMPER-CYL	30	73	6.15	0	13	27	V	0	0	27	8	27	8	7

APPENDIX B. EVOLVED READINESS DEGRADERS

Table B.1 Evolved Readiness Degrader Data for Quarter 4 1996

QUARTER 4 1996

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	EV TR EQ	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
6FNA	3720	PROBE ASS	17	0	25.3	2	0	10	S		0	0	8	8	8	8	10
C7WA	1698	FLAP TE RH	95	176	117.2	6	0	1	V	3	3	7	3	3	3	3	4
FPUA	1463	AILERON LH	57	33	79.83	16	0	9	V	15	24	24	11	11	12	12	13
FQAA	1464	AILERON	61	43	66.4	16	4	7	V	12	23	23	10	10	10	10	13
HF2A	1546	SVO CYL T	42	37	39.4	23	6	35	V		0	0	35	35	35	35	46

Table B.2 Evolved Readiness Degrader Data for Quarter 1 1997

QUARTER 1 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
6FNA	3720	PROBE ASS	17	0	25.3	0	0	9	0	0	0	0	0	0	0	10
C7WA	1698	FLAP LE RH	102	43	117.2	2	0	4	V	12	12	4	0	4	0	9
FPUA	1463	AILERON	64	43	79.83	6	12	21	V	28	28	8	8	8	8	20
FQAA	1464	AILERON	65	43	79 83	8	7	22	V	28	28	19	5	19	5	18
HF2A	1546	SVO CYL T	42	37	39.4	44	6	37	V	0	0	37	14	37	14	33

Table B.3 Evolved Readiness Degrader Data for Quarter 2 1997

QUARTER 2 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ.	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
6FNA	3720	PROBE ASS	17	0	25.3	0	14	15	S	4	4	0	0	0	0	14
C7WA	1698	FLAP LE R	97	118	117.2	2	6	7	V	6	6	0	2	0	2	4
FPUA	1463	AILERON	64	81	79.8	4	12	15	V	19	19	8	8	8	8	11
FQAA	1464	AILERON	64	68	79.8	6	17	51	V	22	22	0	3	0	3	16
HF2A	1546	SVO CYL T	42	37	39 4	35	22	119	V	84	84	0	16	0	16	41

Table B.4 Evolved Readiness Degrader Data for Quarter 3 1997

QUARTER 3 1997																	
												NARF	NARF	SHOP	SHOP	
			AVG	AVG					R	CUM	CUM	CUM	CUM	CUM	CUM	
			MDR	ACT	WKLD	QTY	QTY	QTR	Q	IND	IND	PROD	PROD	PROD	PROD	QTY
FIC	SER	NOMEN	TAT	TAT	STD	F	G	REQ	R	REQ	ACT	REQ	ACT	REQ	ACT	M
6FNA	3720	PROBE ASS	14	67	25.3	3	14	16	S	8	8	3	3	3	3	9
C7WA	1698	FLAP LE R	97	151	117.2	3	12	8	V	8	8	3	1	3	1	4
FPUA	1463	AILERON	64	40	79.8	2	32	29	V	27	27	15	15	15	15	12
FQAA	1464	AILERON	65	56	79.8	0	22	49	V	24	24	15	10	15	10	14
HF2A	1546	SVO CYL T	41	40	39.4	24	22	142	V	72	72	30	9	30	9	43

Table B.5 Evolved Readiness Degrader Data for Quarter 4 1997

QUARTER 4 1997																
												NARF	NARF	SHOP	SHOP	
			AVG	AVG					R	CUM	CUM	CUM	CUM	CUM	CUM	
			MDR	ACT	WKLD	QTY	QTY	QTR	Q	IND	IND	PROD	PROD	PROD	PROD	QTY
FIC	SER	NOMEN	TAT	TAT	STD	F	G	REQ	R	REQ	ACT	REQ	ACT	REQ	ACT	M
6FNA	3720	PROBE ASS	12	0	25.3	0	18	14	S	5	5	1	0	1	0	3
C7WA	1698	FLAP TE R	96	0	117.2	0	8	7	V	6	6	1	0	1	0	6
FPUA	1463	AILERON	63	44	79.8	10	39	17	V	21	21	10	10	11	11	11
FQAA	1464	AILERON	63	52	79.8	9	43	38	V	17	17	5	2	5	2	16
HF2A	1546	SVO CYL T	40	41	39.4	22	35	41	V	54	54	35	19	35	19	29

APPENDIX C. REFORMED READINESS DEGRADERS

Table C.1 Reformed Readiness Degrader Data for Quarter 4 1996

QUARTER 4 1996

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
G55A	1421	WSHLD PNL	52	51	69.85	59	15	10	V	24	24	15	15	15	15	9
HHXA	1427	HYD MOTOR	29	21	7.95	84	24	0	V	35	35	16	16	16	16	19
K1TA	3776	CONTROL,N	14	84	34.1	1	34	22	S	0	0	5	5	5	5	10
PE4A	1543	CANOPY,MO	79	22	125.76	1	5	2	V	3	3	2	2	2	2	1

Table C.2 Reformed Readiness Degrader Data for Quarter 1 1997

QUARTER 1 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
G55A	1421	WSHLD PNL	53	35	79.48	61	9	25	V	27	27	25	8	25	8	17
HHXA	1427	HYD MOTOR	30	35	8.05	130	15	57	V	69	69	45	10	45	10	52
K1TA	3776	CONTROL,N	14	84	34.1	5	35	20	0	0	0	0	0	0	0	9
PE4A	1543	CANOPY,MO	79	0	152.72	2	6	0	V	0	0	0	0	0	0	0

Table C.3 Reformed Readiness Degrader Data for Quarter 2 1997

QUARTER 2 1997

FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	R Q R	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
G55A	1421	WSHLD PNL	52	51	69.85	0	0	73	V	0	0	0	10	0	10	4
HHXA	1427	HYD MOTOR	30	101	8.1	62	15	49	V	99	99	0	12	0	12	59
K1TA	3776	CONTROL,N	14	84	34.1	18	24	37	S	30	30	0	6	0	6	14
PE4A	1543	CANOPY,MO	79	35	152.7	1	4	7	V	6	6	0	2	0	2	3

Table C.4 Reformed Readiness Degrader Data for Quarter 3 1997

QUARTER 3 1997																	
FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	RQR	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
G55A	1421	WSHLD PNL	52	51	69.85	0	0	0	V	0	0	1	1	1	1	1
HHXA	1427	HYD MOTOR	30	106	8.1	30	8	237	V	78	78	26	2	26	2	71
K1TA	3776	CONTROL,N	15	49	34.1	8	22	58	S	27	27	20	0	20	0	33
PE4A	1543	CANOPY,MO	79	32	152.7	0	3	11	V	6	6	3	0	3	0	4

Table C.5 Reformed Readiness Degrader Data for Quarter 4 1997

QUARTER 4 1997																
FIC	SER	NOMEN	AVG MDR TAT	AVG ACT TAT	WKLD STD	QTY F	QTY G	QTR REQ	RQR	CUM IND REQ	CUM IND ACT	NARF CUM PROD REQ	NARF CUM PROD ACT	SHOP CUM PROD REQ	SHOP CUM PROD ACT	QTY M
G55A	1421	WSHLD PNL	52	51	69.85	0	0	22	V	0	0	28	0	28	0	0
HHXA	1427	HYD MOTOR	29	87	8.1	80	7	43	V	109	109	73	40	73	40	41
K1TA	3776	CONTROL,N	16	39	34.1	17	13	35	S	27	27	17	9	17	9	10
PE4A	1543	CANOPY,MO	79	75	152.7	0	2	3	V	4	4	1	0	1	0	2

APPENDIX D. PIECE PART DEMAND FREQUENCY

Table D.1. BS6A Piece Part Demand Frequency

BS6A											
PIECE PART DEMAND FREQUENCY											
	Demand Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
7R 1620-01-135-8825	10	0.77	10	0.77	11	0.85	12	0.92	12	0.71	0.80
7R 1620-01-223-8234	0	0.00	0	0.00	0	0.00	0	0.00	2	0.12	0.02
7R 1620-01-107-6903	1	0.08	1	0.08	1	0.08	3	0.23	1	0.06	0.10
7R 1620-01-107-6803	0	0.00	0	0.00	0	0.00	1	0.08	2	0.12	0.04
7R 1620-01-107-6854	0	0.00	0	0.00	0	0.00	5	0.38	5	0.29	0.14
9Z 5325-01-108-2886	0	0.00	0	0.00	0	0.00	0	0.00	1	0.06	0.01
9Z 3120-01-110-2469	0	0.00	0	0.00	0	0.00	2	0.15	1	0.06	0.04
9Z 5365-01-114-0224	0	0.00	0	0.00	0	0.00	0	0.00	1	0.06	0.01
9Z 5365-01-136-0823	0	0.00	0	0.00	0	0.00	1	0.08	1	0.06	0.03
9Z 5315-01-107-6810	0	0.00	0	0.00	0	0.00	0	0.00	1	0.06	0.01
9Z 5365-01-109-0689	0	0.00	0	0.00	0	0.00	0	0.00	1	0.06	0.01
9Z 5340-01-109-8159	0	0.00	0	0.00	0	0.00	0	0.00	1	0.06	0.01
9Z 5315-01-109-7661	1	0.08	0	0.00	0	0.00	0	0.00	1	0.06	0.03
LP 0000-LL-LM0-0049	0	0.00	0	0.00	0	0.00	1	0.08	0	0.00	0.02
TOTAL O/S PARTS	16		12		14		28		34		
COMPONENTS	13		13		13		13		17		

Table D.2. G5YA Piece Part Demand Frequency

G5YA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
7R 5995-01-190-2353	2	0.12	2	0.09	0	0.00	4	0.17	5	0.16	0.11
7R 5895-01-256-8227	3	0.18	3	0.13	2	0.10	9	0.39	6	0.19	0.20
9N 5998-LL-LP4-6035	0	0.00	0	0.00	0	0.00	1	0.04	1	0.03	0.02
7R 5895-01-166-3388	0	0.00	0	0.00	0	0.00	1	0.04	3	0.10	0.03
LP 0000-LL-LP4-6059	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
7R 5999-01-240-5650	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
7R 5895-01-140-4038	1	0.06	0	0.00	0	0.00	2	0.09	1	0.03	0.04
LP 0000-LL-LP4-6076	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
LP 0000-LL-LP4-6163	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
7R 5998001-140-4171	0	0.00	0	0.00	0	0.00	0	0.00	2	0.06	0.01
7R 5998-01-283-0302	1	0.06	1	0.04	1	0.05	1	0.04	1	0.03	0.05
7R 5995-01-286-6703	5	0.29	8	0.35	10	0.48	1	0.04	3	0.10	0.25
9G 5995-01-162-9381	0	0.00	0	0.00	0	0.00	1	0.04	1	0.03	0.02
9G 5975-LL-LP4-6034	0	0.00	0	0.00	0	0.00	1	0.04	1	0.03	0.02
9N 5895-01-161-8492	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00	0.01
LP-0000-LL-LP4-2413	1	0.06	1	0.04	1	0.05	0	0.00	0	0.00	0.03
7R 5998-01-296-0846	1	0.06	2	0.09	1	0.05	1	0.04	0	0.00	0.05
7R 5998-01-309-5066	0	0.00	1	0.04	0	0.00	1	0.04	0	0.00	0.02
7R 5998-01-140-4169	0	0.00	0	0.00	0	0.00	1	0.04	0	0.00	0.01
9Z 5340-01-152-9334	0	0.00	0	0.00	0	0.00	1	0.04	0	0.00	0.01
9N 5962-01-302-7050	0	0.00	1	0.04	0	0.00	0	0.00	0	0.00	0.01
7R 5895-01-170-8227	1	0.06	3	0.13	4	0.19	0	0.00	0	0.00	0.08
TOTAL O/S PARTS	20		23		21		28		32		
COMPONENTS	17		23		21		23		31		

Table D.3. GQFA Piece Part Demand Frequency

GQFA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
7R 1650-01-161-4443	23	0.92	35	1.09	38	0.88	28	0.76	23	0.72	0.87
9C 1650-01-186-1566	0	0.00	2	0.06	5	0.12	6	0.16	14	0.44	0.16
9C 1650-01-186-1565	0	0.00	0	0.00	3	0.07	4	0.11	10	0.31	0.10
9Z 5305-00-357-1880	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
9C 3040-01-186-1563	11	0.44	1	0.03	2	0.05	0	0.00	1	0.03	0.11
9C 3040-01-191-4338	9	0.36	1	0.03	1	0.02	1	0.03	0	0.00	0.09
9C 3040-01-191-8906	20	0.80	10	0.31	10	0.23	0	0.00	0	0.00	0.27
9C 3040-01-191-8905	8	0.32	1	0.03	0	0.00	0	0.00	0	0.00	0.07
9C 3020-01-192-3043	14	0.56	14	0.44	0	0.00	0	0.00	0	0.00	0.20
9Z 5365-01-129-7076	1	0.04	1	0.03	1	0.02	0	0.00	0	0.00	0.02
9Z 5365-01-138-2183	1	0.04	1	0.03	1	0.02	0	0.00	0	0.00	0.02
9Z 5365-01-138-5914	1	0.04	1	0.03	1	0.02	0	0.00	0	0.00	0.02
LP 0000-LL-L60-2238	1	0.04	0	0.00	0	0.00	0	0.00	1	0.03	0.01
1R 1680-LL-L60-2383	0	0.00	0	0.00	0	0.00	1	0.03	0	0.00	0.01
TOTAL O/S PARTS	93		68		64		43		54	322	
COMPONENTS	25		32		43		37		32		

Table D.4. HCHA Piece Part Demand Frequency

HCHA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
9G 2840-01-187-6580	4	0.02	4	0.02	4	0.02	3	0.03	3	0.02	0.02
9C 3040-01-152-0644	84	0.49	84	0.41	76	0.42	64	0.70	45	0.35	0.47
9G 2915-01-243-8854	3	0.02	4	0.02	5	0.03	5	0.05	4	0.03	0.03
9C 3020-01-134-1350	89	0.51	98	0.48	82	0.45	60	0.66	32	0.25	0.47
9Z 3110-01-164-4139	80	0.46	71	0.35	63	0.35	13	0.14	6	0.05	0.27
1R 3040-01-252-3623	79	0.46	73	0.36	66	0.36	38	0.42	3	0.02	0.32
7R 2840-01-219-6324	1	0.01	9	0.04	9	0.05	10	0.11	3	0.02	0.05
1R 2995-01-243-8850	4	0.02	4	0.02	8	0.04	5	0.05	0	0.00	0.03
7R 4320-00-757-4542	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	0.00
9Z 3110-01-241-2122	10	0.06	0	0.00	0	0.00	0	0.00	0	0.00	0.01
9Z 3110-01-131-2587	10	0.06	10	0.05	10	0.06	5	0.05	0	0.00	0.04
9C 4730-01-323-5011	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	0.00
9Z 3110-01-131-2586	6	0.03	2	0.01	0	0.00	0	0.00	0	0.00	0.01
LP 0000-LL-L60-0685	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	0.00
9C 3020-01-183-4751	1	0.01	2	0.01	0	0.00	0	0.00	0	0.00	0.00
9Z 5365-01-126-1368	2	0.01	2	0.01	0	0.00	0	0.00	0	0.00	0.00
LP 0000-LL-L60-0710	1	0.01	1	0.00	1	0.01	0	0.00	0	0.00	0.00
9Z 5306-00-927-7882	1	0.01	1	0.00	1	0.01	0	0.00	0	0.00	0.00
TOTAL O/S PARTS	382		366		327		206		100		
COMPONENTS	173		204		181		91		130		

Table D.5. KNK1 Piece Part Demand Frequency

KNK1										
PIECE PART DEMAND FREQUENCY										
	Requirement Frequency									
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
9N 5962-00-539-3580	2	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0.05
9N 5962-00-539-3583	2	0.25	2	0.20	1	0.08	1	0.17	0	0.00	0.14
9N 5962-00-539-3558	1	0.12	2	0.20	1	0.08	1	0.17	0	0.00	0.12
9N 5962-00-539-3559	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
9N 5962-00-539-3578	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
9N 5962-00-539-4057	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
9N 5962-00-539-4043	1	0.12	1	0.10	1	0.08	1	0.17	0	0.00	0.09
9N 5962-00-539-4049	1	0.12	2	0.20	2	0.17	2	0.33	0	0.00	0.16
9N 5962-00-539-4051	1	0.12	2	0.20	2	0.17	0	0.00	0	0.00	0.10
9N 5962-00-539-4052	0	0.00	1	0.10	1	0.08	1	0.17	0	0.00	0.07
9N 5962-01-007-6168	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
9N 5962-01-007-6170	1	0.12	1	0.10	0	0.00	0	0.00	0	0.00	0.04
9N 5962-01-007-6171	2	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0.05
9N 5962-01-007-6172	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
1R 5961-01-221-2479	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
7R 5995-00-349-0560	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
7R 5841-01-208-2437	0	0.00	1	0.10	0	0.00	0	0.00	0	0.00	0.02
7R 5841-00-346-2709	0	0.00	0	0.00	1	0.08	0	0.00	0	0.00	0.02
7R 5841-00-357-1294	0	0.00	0	0.00	0	0.00	0	0.00	1	0.08	0.02
TOTAL O/S PARTS	22		13		11		9		5		
COMPONENTS	8		10		12		6		12		

Table D.6. PK86 Piece Part Demand Frequency

PK86											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
9C 1650-01-113-6161	5	0.24	1	0.12	1	0.20	0	0.00	0	0.00	0.11
LP 0000-LL-L60-2146	1	0.05	0	0.00	0	0.00	0	0.00	0	0.00	0.01
LP 0000-LL-L60-2159	1	0.05	1	0.12	1	0.20	0	0.00	0	0.00	0.07
9C 1650-01-113-6171	1	0.05	0	0.00	1	0.20	5	0.26	5	0.38	0.18
LP 0000-LL-L60-2145	0	0.00	0	0.00	6	1.20	11	0.58	6	0.46	0.45
9C 1650-01-113-6042	0	0.00	0	0.00	6	1.20	0	0.00	0	0.00	0.24
1R 2640-00-890-7965	0	0.00	0	0.00	3	0.60	1	0.05	1	0.08	0.15
9C 2990-LL-ND9-0696	0	0.00	0	0.00	0	0.00	1	0.05	0	0.00	0.01
9C 1650-LL-L97-0153	0	0.00	0	0.00	0	0.00	4	0.21	5	0.38	0.12
9C 1650-01-113-6040	0	0.00	0	0.00	0	0.00	0	0.00	1	0.08	0.02
TOTAL O/S PARTS	12		3		20		25		22		
COMPONENTS	21		8		7		19		13		

Table D.7. 6FNA Piece Part Demand Frequency

6FNA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
LP-0000-LL-M60-0816	0	0	0	0	4	0.29	4	0.29	4	0.22	0.26
3G 6105-00-358-1300	0	0	0	0	1	0.07	1	0.07	4	0.22	0.12
9Z 5306-LL-L97-0113	0	0	0	0	13	0.93	13	0.93	6	0.33	0.73
LP-0000-LL-M60-0800	0	0	0	0	1	0.07	1	0.07	1	0.06	0.07
LP-0000-LL-M60-0801	0	0	0	0	1	0.07	1	0.07	1	0.06	0.07
LP-0000-LL-M60-0803	0	0	0	0	1	0.07	1	0.07	1	0.06	0.07
LP-0000-LL-M60-0814	0	0	0	0	1	0.07	1	0.07	0	0.00	0.05
LP-0000-LL-M60-0825	0	0	0	0	1	0.07	0	0.00	0	0.00	0.02
LP-0000-LL-M60-0826	0	0	0	0	1	0.07	0	0.00	0	0.00	0.02
LP-0000-LL-M60-0827	0	0	0	0	1	0.07	1	0.07	1	0.06	0.07
LP-0000-LL-M60-0830	0	0	0	0	1	0.07	0	0.00	0	0.00	0.02
9Z 5315-01-140-7868	0	0	0	0	2	0.14	1	0.07	0	0.00	0.07
9Z 3110-00-413-3952	0	0	0	0	2	0.14	0	0.00	0	0.00	0.05
LP-0000-00-600-9476	0	0	0	0	0	0.00	0	0.00	1	0.06	0.02
9Z 5930-LL-L97-0185	0	0	0	0	0	0.00	0	0.00	4	0.22	0.07
9Z 5305-01-322-7403	0	0	0	0	0	0.00	0	0.00	5	0.28	0.09
3G 6105-00-358-1300	0	0	0	0	1	0.07	1	0.07	4	0.22	0.12
LP-0000-LL-L60-5018	0	0	0	0	1	0.07	0	0.00	0	0.00	0.02
TOTAL O/S PARTS	4		1		34		28		36		
COMPONENTS	0		0		14		14		18		

Table D.8. C7WA Piece Part Demand Frequency

C7WA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
9G 1560-01-330-1927	0	0	0	0	1	0.17	1	0.08	1	0.12	0.12
9G 1560-01-328-2845	0	0	0	0	2	0.33	2	0.17	4	0.50	0.33
9G 1560-01-392-8074	0	0	0	0	0	0.00	0	0.00	1	0.12	0.04
7R 1560-01-399-7554	0	0	0	0	1	0.17	1	0.08	0	0.00	0.08
TOTAL O/S PARTS	4		1		6		7		10		
COMPONENTS	0		0		6		12		8		

Table D.9. FPUA Piece Part Demand Frequency

FPUA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
7R 1560-01-152-0743	0	0	0	0.00	0	0.00	5	0.16	9	0.23	0.10
9G 1560-01-394-5296	0	0	0	0.00	0	0.00	2	0.06	5	0.13	0.05
7R 1560-01-125-7671	0	0	12	2.40	12	1.00	4	0.12	0	0.00	0.88
9G 1560-01394-8082	0	0	0	0.00	1	0.08	3	0.09	9	0.23	0.10
7R 1560-01-383-3306	0	0	0	0.00	1	0.08	2	0.06	2	0.05	0.05
7R 1560-01-152-0743	0	0	0	0.00	0	0.00	5	0.16	9	0.23	0.10
9G 1560-01-393-9211	0	0	0	0.00	0	0.00	2	0.06	2	0.05	0.03
9G 1560-01-392-8047	0	0	0	0.00	0	0.00	0	0.00	2	0.05	0.01
9G 1560-01-226-5115	0	0	0	0.00	0	0.00	0	0.00	1	0.03	0.01
9G 1560-01-366-0712	0	0	0	0.00	1	0.08	3	0.09	0	0.00	0.04
LP 0000-LL-ND8-9086	0	0	1	0.20	1	0.08	0	0.00	0	0.00	0.07
TOTAL O/S PARTS	4		14		18		29		43		
COMPONENTS	0		5		12		32		39		

Table D.10. FQAA Piece Part Demand Frequency

FQAA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
7R 1560-01-125-7672	0	0.00	10	1.43	12	0.71	12	0.55	11	0.26	0.59
9G 1560-01-392-8064	4	1.00	4	0.57	3	0.18	4	0.18	6	0.14	0.41
7R 1560-01-152-0743	0	0.00	0	0.00	0	0.00	2	0.09	2	0.05	0.03
9G 1560-01-394-8082	0	0.00	0	0.00	0	0.00	1	0.05	2	0.05	0.02
7R 1560-01-152-0744	0	0.00	0	0.00	0	0.00	2	0.09	5	0.12	0.04
9G 1560-01-394-5301	0	0.00	0	0.00	0	0.00	6	0.27	14	0.33	0.12
9G 1560-01-394-5295	0	0.00	1	0.14	1	0.06	1	0.05	1	0.02	0.05
1R 2840-LL-ND8-9086	0	0.00	2	0.29	3	0.18	2	0.09	1	0.02	0.12
9G 1560-01-374-5760	0	0.00	0	0.00	0	0.00	0	0.00	1	0.02	0.00
9G 1560-01-393-9203	0	0.00	0	0.00	1	0.06	1	0.05	1	0.02	0.03
9G 1560-01-383-3314	0	0.00	0	0.00	0	0.00	1	0.05	2	0.05	0.02
7R 1560-01-383-3394	0	0.00	0	0.00	0	0.00	3	0.14	1	0.02	0.03
9G 1560-01-226-5115	0	0.00	0	0.00	0	0.00	2	0.09	4	0.09	0.04
9G 1560-01-392-8048	0	0.00	0	0.00	0	0.00	1	0.05	1	0.02	0.01
9Z 1560-01-394-4107	0	0.00	0	0.00	0	0.00	1	0.05	4	0.09	0.03
9G 1560-01-125-7683	0	0.00	0	0.00	0	0.00	1	0.05	5	0.12	0.03
1R 1560-01-181-5545	0	0.00	0	0.00	0	0.00	0	0.00	1	0.02	0.00
LP 0000-LL-LM3-0854	0	0.00	0	0.00	0	0.00	0	0.00	1	0.02	0.00
9G 1560-01-393-9210	0	0.00	0	0.00	0	0.00	0	0.00	1	0.02	0.00
TOTAL O/S PARTS	8		18		22		43		68		
COMPONENTS	4		7		17		22		43		

Table D.11. HF2A Piece Part Demand Frequency

HF2A											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
7R 1650-01-161-4367	1	0.17	1	0.17	1	0.05	1	0.05	1	0.03	0.09
7R 1650-01-125-7180	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
7R 4810-01-143-5351	0	0.00	10	1.67	12	0.55	1	0.05	5	0.14	0.48
7R 1650-01-143-5655	0	0.00	0	0.00	2	0.09	7	0.32	1	0.03	0.09
7R 1650-01-166-4913	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
9G 6695-01-125-7335	0	0.00	0	0.00	0	0.00	5	0.23	0	0.00	0.05
7R 1650-01-161-4368	1	0.17	3	0.50	3	0.14	4	0.18	3	0.09	0.21
7R 1650-01-351-3374	2	0.33	2	0.33	4	0.18	6	0.27	4	0.11	0.25
1R 1650-01-125-7172	0	0.00	0	0.00	1	0.05	1	0.05	0	0.00	0.02
7R 1650-01-351-3372	0	0.00	0	0.00	0	0.00	1	0.05	1	0.03	0.01
9C 3040-01-373-6443	0	0.00	0	0.00	0	0.00	1	0.05	1	0.03	0.01
7R 1650-01-168-9476	0	0.00	0	0.00	0	0.00	1	0.05	1	0.03	0.01
9G 1680-00-466-9915	0	0.00	0	0.00	0	0.00	1	0.05	1	0.03	0.01
9C 1650-01-145-2558	0	0.00	6	1.00	4	0.18	0	0.00	0	0.00	0.24
7R 1650-01-198-7705	0	0.00	1	0.17	0	0.00	1	0.05	2	0.06	0.05
9C 1650-01-125-7142	0	0.00	0	0.00	0	0.00	1	0.05	1	0.03	0.01
7R 1650-01-161-4369	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
9C 1650-01-167-7311	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03	0.01
9C 1650-01-356-4617	1	0.17	0	0.00	0	0.00	0	0.00	1	0.03	0.04
LP-0000-LL-L60-2169	1	0.17	1	0.17	0	0.00	0	0.00	0	0.00	0.07
9Z 5310-01-133-7922	0	0.00	0	0.00	0	0.00	1	0.05	0	0.00	0.01
9Z 5310-01-129-6948	0	0.00	1	0.17	1	0.05	0	0.00	0	0.00	0.04
9C 1650-01-351-2093	0	0.00	1	0.17	1	0.05	0	0.00	0	0.00	0.04
TOTAL O/S PARTS	10		27		31		35		30		
COMPONENTS	6		6		22		22		35		

Table D.12. B64A/G55A Piece Part Demand Frequency

B64A/G55A											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
LP 0000-LL-LP3-1708	1	0.07	1	0.11	1	0.17	0	0.00	0	0.00	0.07
LP 0000-LL-LP3-1709	1	0.07	1	0.11	1	0.17	1	1.00	1	0.20	0.31
LP 0000-LL-LP3-1710	1	0.07	1	0.11	1	0.17	0	0.00	0	0.00	0.07
LP 0000-LL-LP3-1711	1	0.07	1	0.11	1	0.17	0	0.00	0	0.00	0.07
LP 0000-LL-LP3-1861	1	0.07	1	0.11	1	0.17	0	0.00	0	0.00	0.07
LP 0000-LL-LP3-3060	1	0.07	1	0.11	1	0.17	0	0.00	0	0.00	0.07
9G 1560-01-125-7767	0	0.00	0	0.00	0	0.00	0	0.00	1	0.20	0.04
9G 1560-01-236-7436	0	0.00	3	0.33	1	0.17	0	0.00	2	0.40	0.18
9G 1560-01-325-9237	0	0.00	0	0.00	0	0.00	0	0.00	2	0.40	0.08
9G 1560-01-156-6788	0	0.00	0	0.00	0	0.00	0	0.00	1	0.20	0.04
LP-0000-LL-ND8-9189	0	0.00	2	0.22	0	0.00	0	0.00	0	0.00	0.04
1R 1560-01-176-7594	6	0.40	2	0.22	0	0.00	0	0.00	0	0.00	0.12
9G 1560-01-303-8400	0	0.00	0	0.00	2	0.33	0	0.00	0	0.00	0.07
TOTAL O/S PARTS	16		14		11		4		11		
COMPONENTS	15		9		6		1		5		

Table D.13. HHXA Piece Part Demand Frequency

HHXA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
9Z 5340-LL-L60-2359	0	0.00	0	0.00	0	0.00	1	0.12	0	0.00	0.02
9Z 5365-LL-L97-0151	0	0.00	0	0.00	0	0.00	1	0.12	0	0.00	0.02
9C 3040-01-357-1227	6	0.25	8	0.27	0	0.00	1	0.12	0	0.00	0.13
9Z 5315-01-133-0857	1	0.04	0	0.00	0	0.00	0	0.00	0	0.00	0.01
9C 3040-01-128-9250	4	0.17	7	0.23	6	0.40	3	0.38	0	0.00	0.24
LP 0000-LL-L60-2212	2	0.08	0	0.00	1	0.07	1	0.12	0	0.00	0.05
9Z 5365-01-129-2161	1	0.04	1	0.03	1	0.07	0	0.00	0	0.00	0.03
9Z 5330-01-125-7658	3	0.12	3	0.10	0	0.00	0	0.00	0	0.00	0.04
LP 0000-LL-L60-2211	1	0.04	0	0.00	0	0.00	0	0.00	0	0.00	0.01
9Z 5330-LL-L60-2259	0	0.00	0	0.00	0	0.00	1	0.12	0	0.00	0.02
TOTAL O/S PARTS	22		20		10		11		4		
COMPONENTS	24		30		15		8		7		

Table D.14. K1TA Piece Part Demand Frequency

K1TA											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
9G 5975-00-351-5371	14	0.41	8	0.23	8	0.33	1	0.05	1	0.08	0.22
LP 0000-LL-LP4-3992	3	0.09	3	0.09	1	0.04	1	0.05	0	0.00	0.05
LP 0000-LL-LP4-3990	7	0.21	3	0.09	2	0.08	1	0.05	1	0.08	0.10
LP 0000-LL-LP4-3988	12	0.35	12	0.34	5	0.21	5	0.23	1	0.08	0.24
LP 0000-LL-LP4-3991	2	0.06	2	0.06	2	0.08	1	0.05	1	0.08	0.06
LP 0000-LL-LP4-3993	5	0.15	5	0.14	4	0.17	0	0.00	0	0.00	0.09
LP 0000-LL-LP4-4309	1	0.03	0	0.00	0	0.00	0	0.00	0	0.00	0.01
LP 0000-LL-LP4-4310	1	0.03	0	0.00	0	0.00	0	0.00	0	0.00	0.01
LP 0000-LL-LP4-4308	1	0.03	0	0.00	0	0.00	0	0.00	0	0.00	0.01
9G 6350-01-014-8674	4	0.12	0	0.00	0	0.00	0	0.00	0	0.00	0.02
9N 5930-01-005-0337	1	0.03	1	0.03	1	0.04	0	0.00	0	0.00	0.02
9N 5905 00-279-4059	6	0.18	0	0.00	0	0.00	0	0.00	0	0.00	0.04
LP 6695-LL-LP4-3989	1	0.03	0	0.00	0	0.00	0	0.00	0	0.00	0.01
9G 5999-01-031-3985	10	0.29	0	0.00	0	0.00	0	0.00	0	0.00	0.06
XX 0000-00-518-5568	2	0.06	2	0.06	1	0.04	0	0.00	0	0.00	0.03
9G 6240-01-014-9044	6	0.18	0	0.00	0	0.00	0	0.00	0	0.00	0.04
LP 0000-01-201-2656	0	0.00	1	0.03	1	0.04	1	0.05	1	0.08	0.04
9N 5930-01-005-0343	0	0.00	1	0.03	1	0.04	1	0.05	1	0.08	0.04
9N 5935-01-093-2400	0	0.00	0	0.00	0	0.00	3	0.14	0	0.00	0.03
LP 0000-LL-LP4-6062	0	0.00	0	0.00	0	0.00	1	0.05	1	0.08	0.02
LP 0000-LL-LP4-6154	0	0.00	0	0.00	0	0.00	0	0.00	1	0.08	0.02
LP 0000-LL-LP4-6160	0	0.00	0	0.00	0	0.00	0	0.00	1	0.08	0.02
LP 0000-LL-LP4-6165	0	0.00	0	0.00	0	0.00	0	0.00	1	0.08	0.02
LP 0000-LL-LP4-6166	0	0.00	0	0.00	0	0.00	0	0.00	1	0.08	0.02
TOTAL O/S PARTS	80		39		28		18		15		
COMPONENTS	34		35		24		22		13		

Table D.15. PE4A Piece Part Demand Frequency

PE4A											
PIECE PART DEMAND FREQUENCY											
	Requirement Frequency										
NIIN	4-96	%	1-97	%	2-97	%	3-97	%	4-97	%	Overall %
9G 1650-01-325-2478	4	0.80	0	0.00	0	0.00	0	0.00	1	0.50	0.26
3G 1560-01-170-3991	0	0.00	1	0.17	2	0.50	1	0.33	1	0.50	0.30
3G 1560-01-1691739	0	0.00	0	0.00	1	0.25	0	0.00	1	0.50	0.15
LP 0000-LL-LM3-0910	0	0.00	0	0.00	0	0.00	1	0.33	0	0.00	0.07
LP 0000-LL-LM3-1931	0	0.00	0	0.00	0	0.00	1	0.33	0	0.00	0.07
LP 0000-LL-RMA-0776	0	0.00	0	0.00	0	0.00	0	0.00	1	0.50	0.10
LP 0000-LL-RMA-0777	0	0.00	0	0.00	0	0.00	0	0.00	1	0.50	0.10
9G 1560-01-313-0121	0	0.00	0	0.00	0	0.00	0	0.00	1	0.50	0.10
9G 1560-01-344-7669	0	0.00	0	0.00	0	0.00	0	0.00	1	0.50	0.10
9G 1560-LL-LP3-3321	0	0.00	0	0.00	0	0.00	0	0.00	1	0.50	0.10
TOTAL O/S PARTS	8		2		5		6		12		
COMPONENTS	5		6		4		3		2		

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